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Engineering Applied to Maintenance in Unique "Servicenter" Building

By J. F. Winchester

Coordinator and Supervisor of Motor Equipment, Standard Oil Co. of N. J.

ACROSS the span of twenty-five years' time, there have been definite and interesting changes in shop maintenance methods. First we had the era of small, dirty congested spaces in which repair work was done.

Then methods and equipment were improved and, in a relatively short period, we advanced from the repair methods of the one-horse shay day to those of the storage garage with its gasoline pump; then to the modern service station and now to the Servicenter, probably the most modern service development in the world.

The Servicenter, located in Washington, D. C., is operated by the Standard Oil Co. of New Jersey. In it, cars and light trucks are serviced in a uniquely efficient manner productive of economy to the car owner and of a profitable operation to the proprietor.

The specially constructed building which houses this novel maintenance operation is shown in the photograph at the bottom of this page, while on following pages the detail of the various operations is visualized in special photographs and described in brief paragraphs.

In a building such as this, engineering problems of all types are involved. Complete, careful inspection of the entire unit is necessary in order for one to recognize the hidden mass of detailed technical problems involved, in addition to those having to do with the selection and placement of the machinery which meets the eye of the casual visitor. Any engineer could spend two or three interesting weeks going into the various phases of engineering involved.

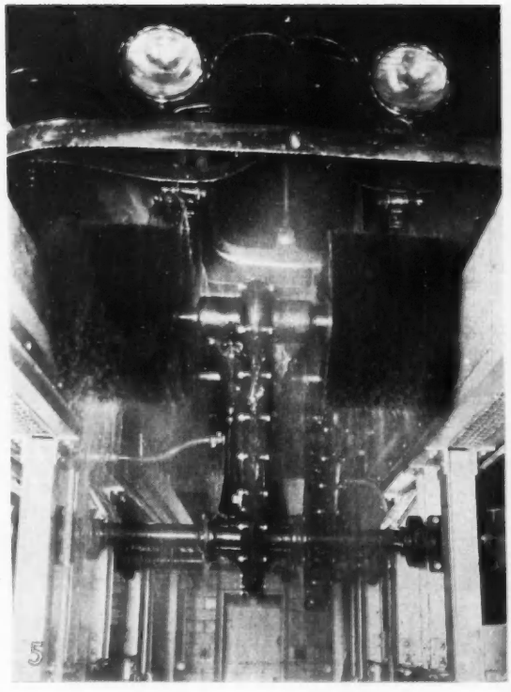
This article is based on excerpts from a paper read by Mr. Winchester before the Philadelphia Section in April, 1933.

(1) The Capitol Servicenter building, recently opened in Washington, D. C. Located in the neighborhood of the Capitol, this modern passenger-car service plant conforms in style and architecture to the plans of the Fine Arts commission for the beautification of the national Capitol.

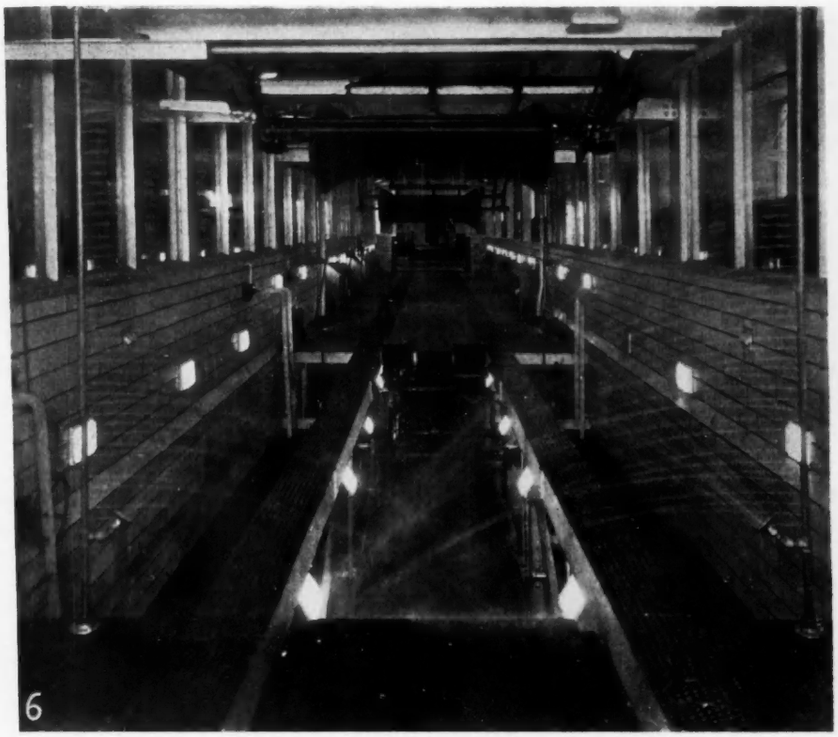
(2) The main driveway on the first floor of the Capitol Servicenter. The lubrication and wash tracks are in the tile and glass enclosures on the left and motor fuel and motor oil pump islands are shown at the right. The patents on this apparatus are owned by the Standard Oil Co. of N. J. Guy Lynn Rosebrook, architect of the company was the original patentee of the lubrication track and many of the other inventions used in this servicenter.

(3) Neatness and cleanliness go hand in hand at the six pump islands located inside the six front entrances to this new plant. Twenty-one gasoline pumps, each capable of delivering 20 gal. per minute assure the motorist of an immediate and quick supply of fuel.

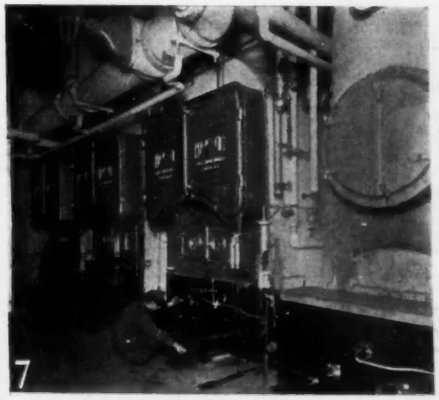
(4) On the washing track all set for a scrubbing—water has not yet been turned on but the men are in position with nozzles ready to wash the under part of the car and wheels with warm water and soap delivered at 400 lb. pressure per sq. in. The brushes in the foreground are ready to go to work on the chassis as soon as the car advances. The overhead brushing mechanism not only cleans the top but also oils it.



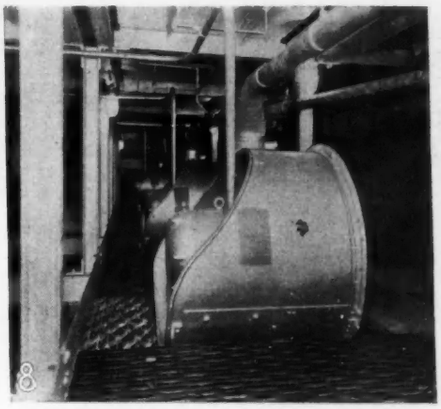
(5) Warm water is being delivered through these giant brushes at high pressure as they whirl and make quick work of cleaning the chassis.



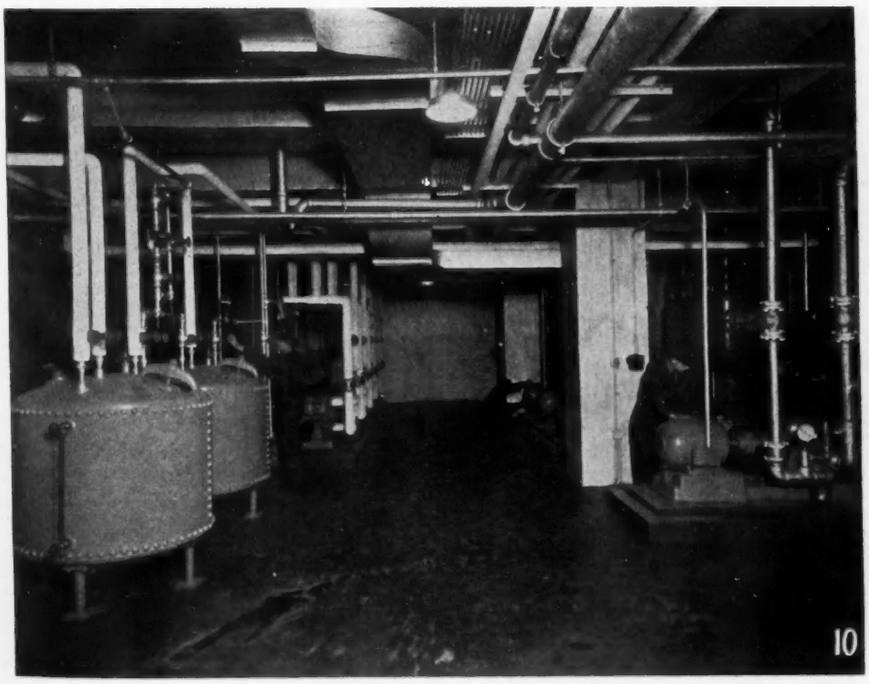
(6) The general spraying arrangement of water on the brushes and the track. After the scrubbing, the body is covered with a polishing emulsion and washed with low pressure hoses. The water is blown off with low air pressure and the car is rubbed dry with a clean chamois. Windows are cleaned and a vacuum cleaning of the interior completes the "wash" job. The patents on the brushing machinery are owned and controlled by the Standard Oil Co. of N. J. and probably represents the first effort of its kind to perform this operation in such a manner.



(7) These oil-fired boilers which serve the Capitol Servicenter, are installed in the basement—15 ft. under sea level.

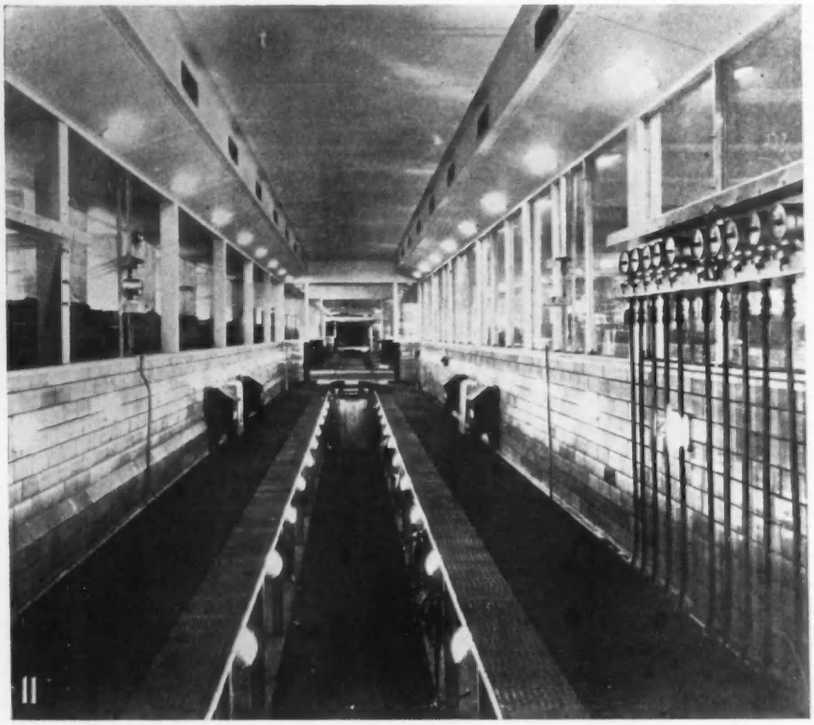


(8) Another part of the mechanical backbone of the servicenter, this vacuum equipment is used in connection with the car washing operations.



(9) This battery of oil tanks contains various grades of oil which is forced directly to the island dispensers.

(10) Soap, warm water and pressure combine to do a thorough washing job. These pumps and soap mixing machinery (left) play an important part in washing cars clean.

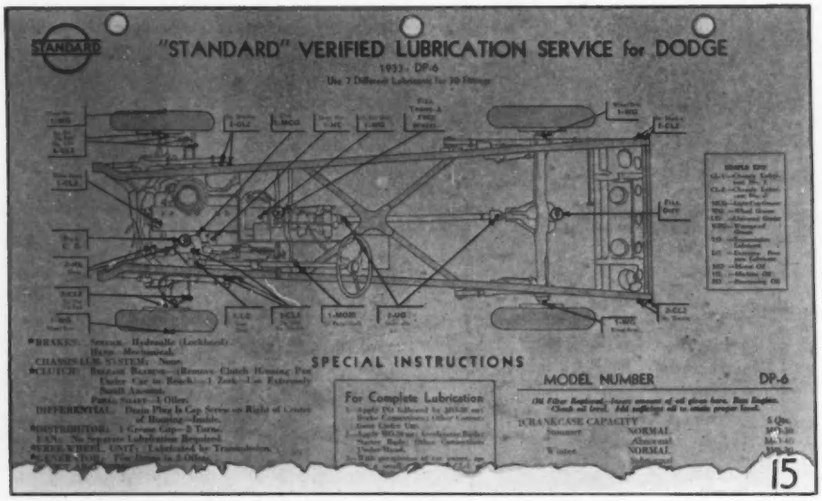


(11) Probably the most interesting equipment for servicing the mechanism of the car is this moving track on which the greasing job is done. The meter equipment on the right measures the oil which is placed directly in the crankcase. This, it is believed, is the first attempt in the East to grease cars on a moving track.

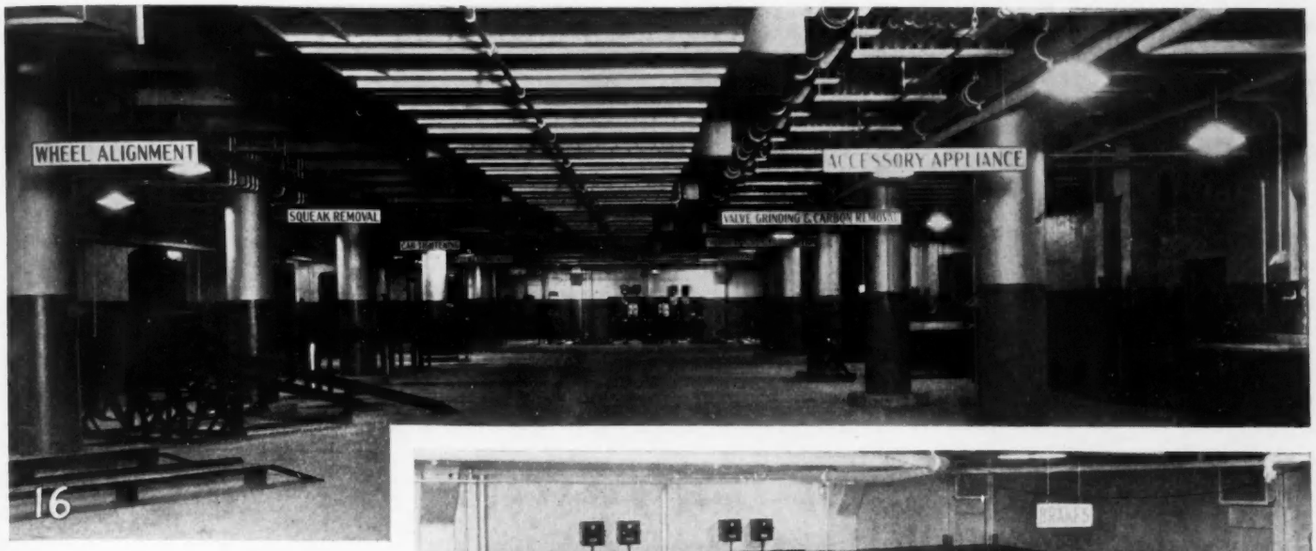
(12) Up-to-date gun type greasing equipment is standard at the Capitol plant. This is shown here together with the dispensing apparatus from which the grease is forced to supply the gun.

(13) Good lighting facilitates the greasing processes performed on the car as it moves along the track.

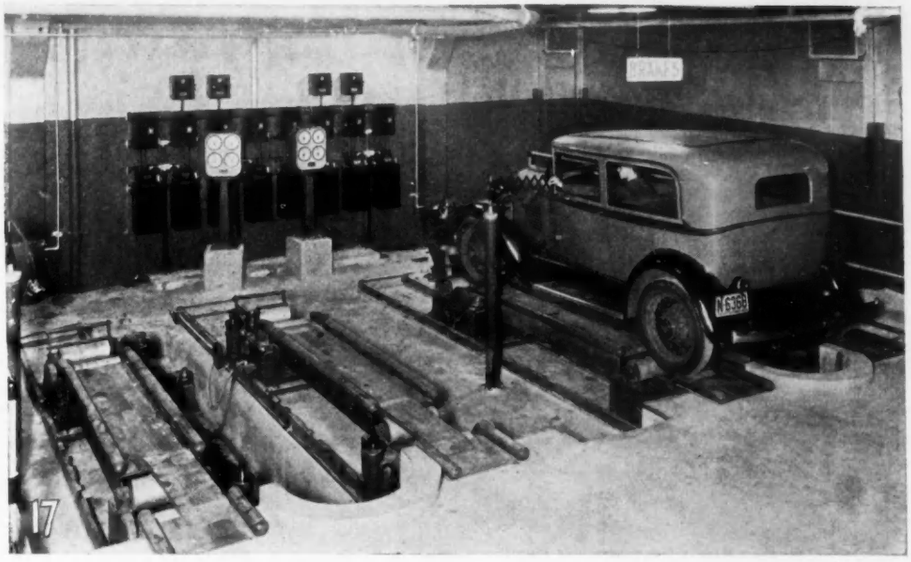
(15) Lubrication requirements of each car are studied carefully and before the car enters the track it is correctly tagged with a lubrication diagram especially prepared for it. Arrows printed in red on the diagram indicate the various fittings to be greased. The kind of lubricant also is clearly indicated. All diagrams are similar to the one illustrated below. They represent an exclusive study made by the Standard Oil Co. of N. J. and is the result of cooperative effort with various engineers of the S.A.E.



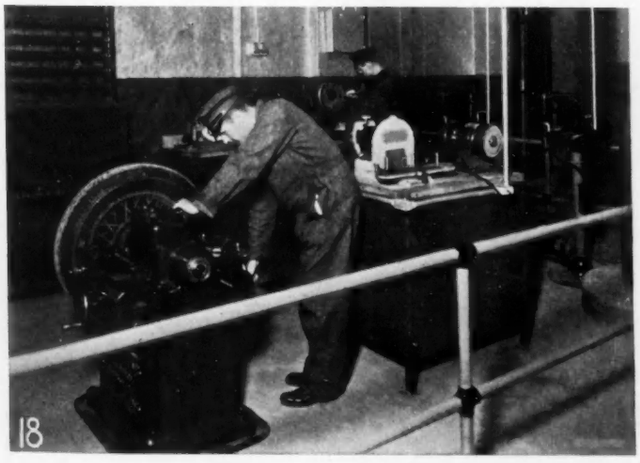
(14) Oil is taken by vacuum direct from the crankcase to the slop oil tank in which the crankcase drainings are stored.



(16) View of the lower floor of the servicenter building which houses an array of testing and service equipment. Directly overhead is a ventilating system which changes the air six times an hour, the new air being filtered and tempered before it is introduced. When engines are being run, in order to analyze exhausts for carbureter adjustment or for other purposes, the exhaust pipes are directly connected to the ventilating system. With this arrangement there is no discomfort when engines are operated and but few odors are noticeable.



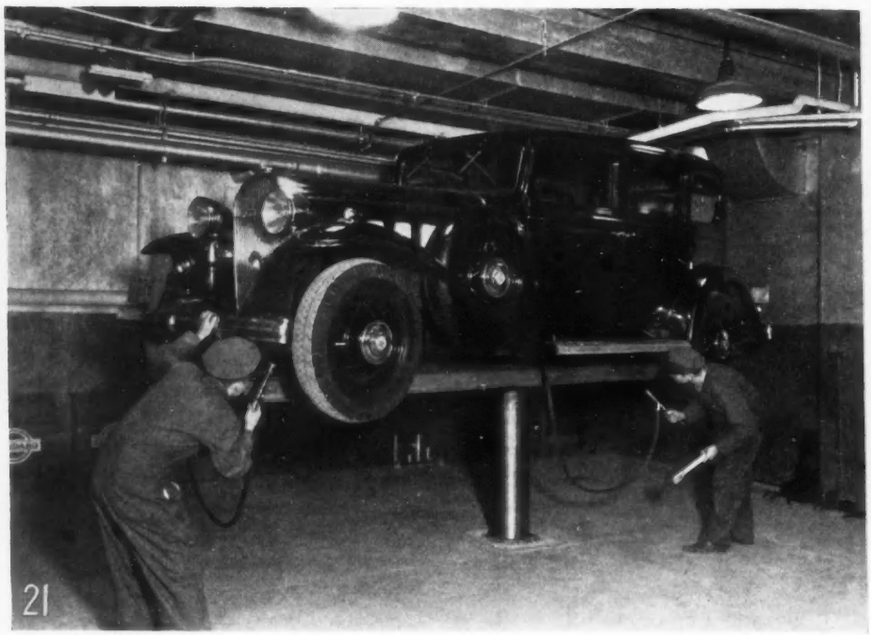
(17) The arrangement for relining brakes on different types of cars comprises one of the most interesting departments in the basement. Two brake testing machines are used which duplicate road conditions and register the efficiency of each wheel on a dial and make absolute alignment possible.



(18) If tests show that brakes need attention there is available brake-drum truing equipment and other machinery for applying new brake lining. The drum lathe is made with the accuracy of airplane engines.

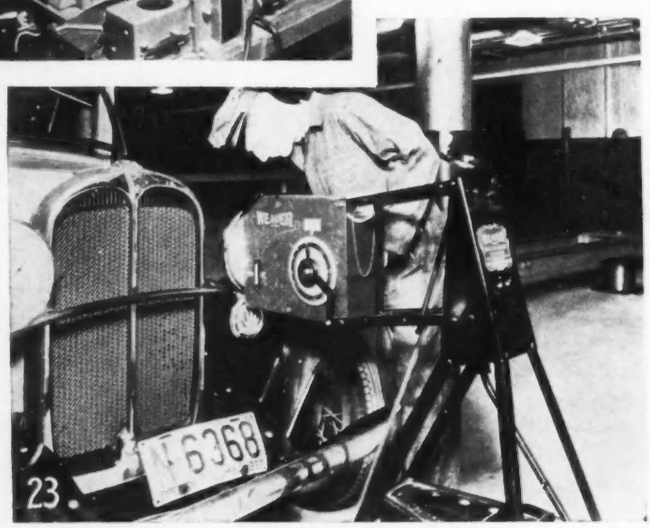
(19) No time is lost at the Capitol by hunting for tools. A tool cabinet is located near the seven lifts which are used when removing wheels for relining brakes and various other services.

(20) This exacting device and a trained operator measure the accuracy of caster and camber of front wheel equipment and make necessary corrections.

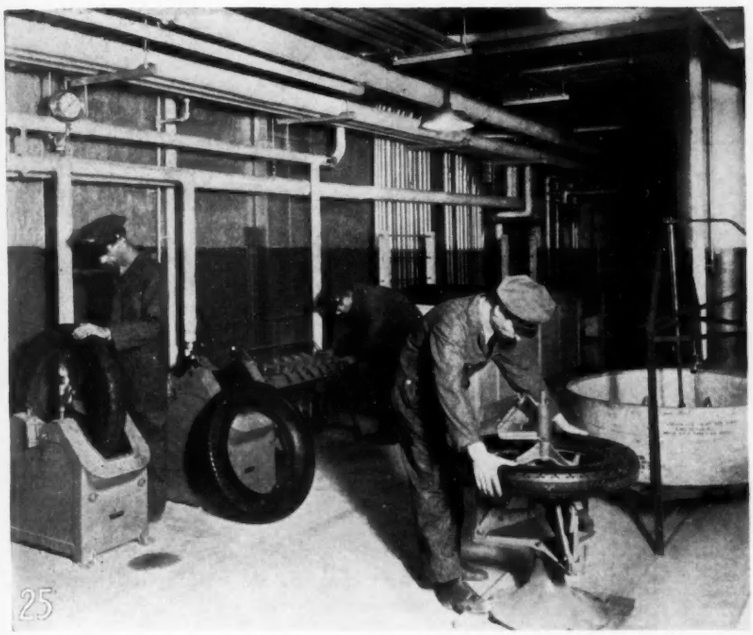


(21) Occasionally a specialized greasing service is necessary on a chassis where greasing fittings have been so infrequently used that much more than the usual time is required on the car in order to free the spring shackle grooves to permit grease being forced through them. This service work also is performed on the lower floor.

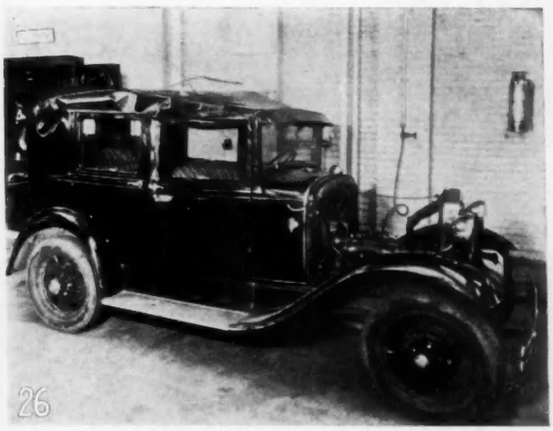
(22-23) Scientific and modern electrical testing service is given all cars. The illustrations show ignition system and headlight testing devices in operation.

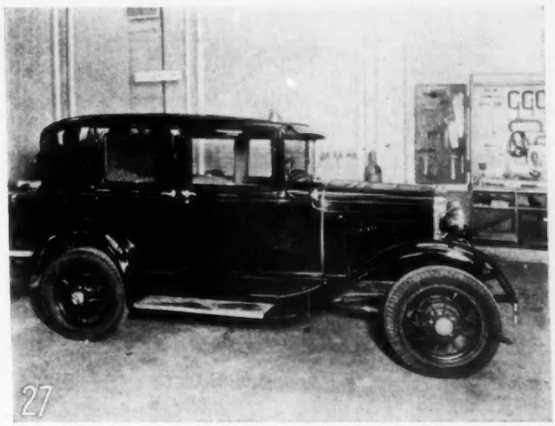


(24) Radiator repairs (below) constitute an important phase of maintenance and service.



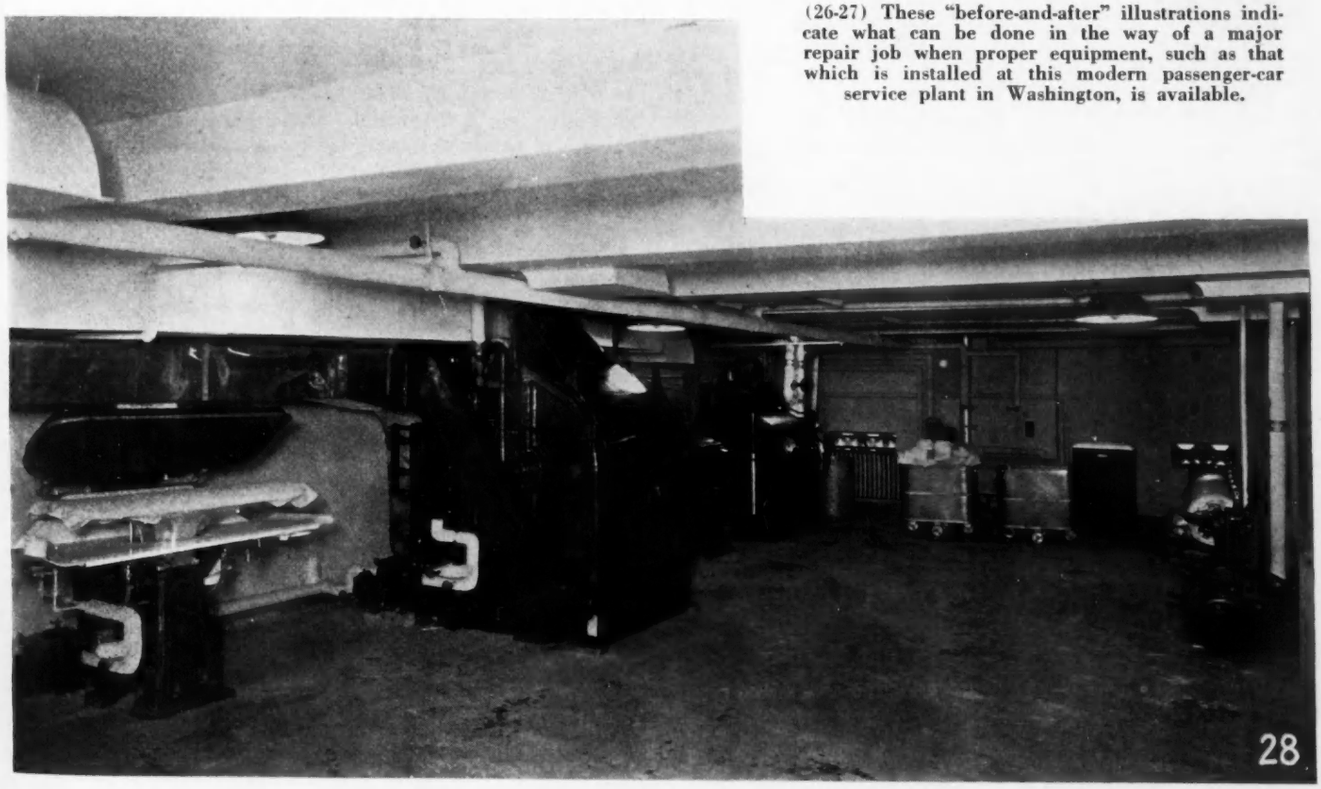
(25) The importance of tire repair work is appreciated and every facility is placed at the command of the Capitol's personnel to do such work efficiently.





(26-27) These "before-and-after" illustrations indicate what can be done in the way of a major repair job when proper equipment, such as that which is installed at this modern passenger-car service plant in Washington, is available.

(28) Dirt is not tolerated by the Capitol Servicenter which maintains complete laundry equipment to take care of the daily requirements of the plant.



Standard Rating Needed for Fuels for High-Speed Oil-Engines

By Max Hofmann

Diesel Engineer, Waukesha Motor Co.

ONCE a method for standard Diesel-fuel knock-rating has been established, a standard for Diesel-fuel specifications should be set which will cover standard knock-rating, gravity, viscosity, pour point, Conradson carbon, water, sediment and sulphur content. The last three items have an important influence on the wear and depreciation of the engine as well as on the carbon formation in the combustion chamber.

The foregoing conclusions are reached after the author has treated the subject in general as well as in particular, under the headings: Combustion process, delay period, turbulence, drop-size, variable delay-time, spontaneous and controlled combustion, chemical characteristics of the fuel and physical properties. Practical methods for oil-engine-fuel knock-ratings are also suggested.

ONE of the most perplexing problems confronting the designer and the operator of high-speed Diesel and oil-engines today is the adaptation of their engines to the available fuels or the selection of suitable fuels for existing engines. For reasons to be explained later, the high-speed Diesel-engine is more sensitive in regard to the various fuels than is its slow-speed companion. This fact, combined with the lack of available data regarding those characteristics of fuel oils which have an influence on their ignition, degree of roughness and combustion in the engine, has seriously handicapped the progress of the high-speed Diesel-engine for a long time.

The last year has seen most remarkable progress toward the solution of this problem. Valuable reports on researches analyzing the phenomena of ignition and combustion roughness in Diesel engines have been published here and abroad. In view of these publications, it seems justifiable now to say that there is no longer any excuse for the usual hit-or-miss methods of selecting fuels suitable for the various types of oil engines. The time has come when Diesel designers and fuel producers must cooperate to produce a standard rating for oil-engine fuels. This rating should permit the engineer to judge whether a certain fuel will burn without objectionable combustion knock in a certain type of engine; in other words, it should be similar to the octane rating, now universally adopted for carbureter fuels.

This suggestion is by no means intended to insinuate that new, special fuels are needed for high-speed oil-engines. There is a wide variety of fuels suitable for all types of oil engines available on the market today, but as yet we have no true yardstick with which to measure their suitability for these various types of engines. May it also be said here that there is no real reason for the widespread belief that the automotive Diesel-engine is as critical in regard to fuels as is the modern high-compression carbureter-engine. While it is more sensitive than the slow-speed engine which will digest practically all kinds of petroleum products, a correctly designed automotive Diesel can be operated with a much larger variety of fuels than can any carbureter engine. The object of this paper is to discuss the standing of modern Diesel-engine fuel-research, to emphasize its practical value for the automotive oil-engine designer and operator and to suggest a way leading to the ultimate standardization of ratings for such fuels.

Combustion Process.—A brief review of the combustion process in Diesel engines will be helpful to this purpose. Harry R. Ricardo[1] divided this process into three stages; first, the "ignition delay" or "delay period", which represents the interval between the beginning of the fuel injection into the combustion chamber and the beginning of combustion as evidenced by a pressure rise above the compression lines in the indicator diagram. This delay period is explained by the fact that the fuel droplets enter the combustion chamber in a relatively cool state and require some time to absorb enough heat for self-ignition. The second stage is that of spontaneous or uncontrolled combustion, meaning the more or less close to constant-volume combustion of that part of the fuel which entered the combustion chamber during the delay period. The third and final stage is usually called controlled combustion, when, due to the heat generated by the second stage, the fuel burns immediately after leaving the nozzle.

Delay Period.—Let us assume that in a given engine the heat conditions of the combustion chamber and the temperature of the compressed-air charge at the beginning of the injection remain the same at various engine speeds. In this

[This paper was presented at the 1933 Annual Meeting of the Society.]

[1] See *The Automobile Engineer*, vol. 20, April, 1930, pp. 151-156; Combustion in Diesel Engines, by H. R. Ricardo.

case the delay period for a certain fuel is practically constant in time, regardless of engine speed. If this engine has an ignition delay of 0.002 sec. at 250 r.p.m., the crankshaft will travel 3 deg. during this time. At 1000 r.p.m., however, this same 0.002-sec. delay represents a crankshaft travel of 12 deg. As the injection period at full load on most Diesel engines takes place during approximately 25 deg. of crankshaft travel this means that, at 250 r.p.m., about one-eighth of the fuel charge is present in the combustion chamber when self-ignition occurs; at 1000 r.p.m., about one-half of the fuel is present and available for spontaneous combustion. This example at once illustrates why it is harder to obtain combustion without knock in a high-speed engine than in a slow-speed engine, why a fuel giving smooth performance at slow speeds may knock at higher speeds and why a high-speed Diesel-engine is more sensitive to fuels than is a slow-speed engine.

Turbulence.—The investigations published by Le Mesurier and Stansfield[2] have proved that the turbulence of the compressed-air charge has hardly any direct influence on the delay period. This statement can be explained by the fact that the movement of the fuel droplets is so much more rapid than is the air movement that it cannot measurably influence the rate of heat transfer from the air to the droplets. It has been proved experimentally, however, that the indirect influence of turbulence on the delay period is quite large. First, the length of the delay period depends upon the difference between the temperature of the compressed air at the end of the compression stroke and the self-ignition characteristics of the fuel at the corresponding compression pressure. The delay period will always be shortened with an increase of the air temperature at the end of the compression stroke. If a movement has been imparted to an air charge during the intake and the compression strokes, this air obviously will come into more intimate contact with and absorb more heat from the hot combustion-chamber walls than will stagnant air. For this reason the air temperature at the end of the compression stroke can be expected to be higher in an engine with turbulence, even if it has the same compression ratio and volumetric efficiency.

Fuel-Droplet Size.—It was also generally believed that the size of the fuel droplet had a marked influence on the delay period. Supporters of this theory maintained that the increase in ratio between drop surface and volume with smaller drops would facilitate evaporation and thus shorten the delay period. But experiments have shown that, within the limits of high and low-pressure ignition and the consequent drop sizes as used in modern engines, no appreciable change of the delay period for a certain fuel could be found. For an explanation of this fact, the investigations of Wollers and Ehmcke[3], Tausz and Schulte[4], as well as the mathematical study of this subject by Neumann[5], are cited. These investigators prove, by experiment and theory, that only a very small percentage of the fuel injected during the delay period has time to evaporate. In view of this fact it seems safe to conclude that the difference in drop size between low and high-pressure injection is not large enough to affect the vapor formation to such a degree that it can alter the delay period. Le Mesurier and Stansfield[6] draw the conclusion that it is the high surface-temperature rather than a high mean-temperature of the fuel drop which causes its ignition.

"There is no longer any excuse for the hit-or-miss methods of selecting fuels suitable for the various types of oil engines. The time has come when Diesel designers and fuel producers must cooperate to produce a standard rating for oil-engine fuels."

* * * *

"It is by no means intended to insinuate that new, special fuels are needed for high-speed oil-engines. A wide variety of fuels suitable for all types of oil engines is available on the market today, but as yet we have no true yardstick with which to measure their suitability for these various types of engines."

Other Considerations Involved

Variable Delay Time.—A positive limit for the maximum speeds attainable in automotive Diesel-engines would exist if the assumption made under "Delay Period" were correct. Fortunately, however, the delay period must not necessarily remain constant in time with increasing engine speed if the factors which affect it are recognized and incorporated in the design. With correctly dimensioned intake valves and valve timing, the volumetric efficiency can be made to increase with the engine speed and hence, also, the compression pressure and temperature for a given compression ratio. Further, the heat generated within a given time in the combustion chamber increases with the engine speed as well as with the turbulence of the air charge. As the parts forming the combustion chamber become hotter and the air charge moves more rapidly, the heat absorbed by it during the intake and the compression stroke will increase with the engine speed while, at the same time, the heat loss per working cycle to the cooling medium will decrease. All these factors combine to obtain a higher air-temperature at the end of the compression stroke at higher engine-speeds, which, in turn, reduces the delay-period time. Hot zones may exist or can be intentionally created in the combustion chamber, through which the fuel spray can be made to travel before it starts burning, and produce the same effect.

The requirement for injection advance and retard at the varying operating speeds used by the different types of high-speed Diesel-engines is a simple yardstick for gaging the degree of effectiveness with which the factors previously mentioned have been utilized in their design. There are engines demanding a large advance of the injection period with only a small increase of speed; on the other hand, designs of automotive Diesel-engines are known to operate on speeds ranging from 300 to 2500 r.p.m. with no need whatever for a variable fuel-injection timing.

[2] See *Transactions of the North-East Coast Institution of Engineers and Shipbuilders*, vol. 49, February, 1932, pp. 195-220; Combustion in Heavy Oil Engines, by L. J. Le Mesurier and R. Stansfield.

[3] See *Kruppsche Monatshefte*, vol. 2, January, 1921, pp. 1-20; Der Vergasungsvorgang der Treibmittel, die Oelgasbildung und das Verhalten der Oeldaempfe und Oelgase bei der Verbrennung im Dieselmotor, by G. Wollers and V. Ehmcke.

[4] See *Zeitschrift des Vereines Deutscher Ingenieure*, vol. 68, 1924, pp. 574-578; Ueber Zuendpunkte und Verbrennungsvorgaenge im Dieselmotor, by Tausz and Schulte.

[5] See *Zeitschrift des Vereines Deutscher Ingenieure*, vol. 70, 1926, pp. 1071-1078; Untersuchungen ueber die Selbstenzuendung fluessiger Brennstoffe, by Neumann.

[6] See *Transactions of the North-East Coast Institution of Engineers and Shipbuilders*, vol. 49, February, 1932, pp. 195-220; Combustion in Heavy Oil Engines, by L. J. Le Mesurier and R. Stansfield.

"The first of the three stages of the combustion process is called the 'ignition-delay' or 'delay period'; the second, that of spontaneous or uncontrolled combustion; and the third, that of controlled combustion."

* * * *

"All oil-engine fuels are heterogeneous mixtures of a large number of hydrocarbons, each of which has its different chemical composition and its particular molecular structure. The important fact is that the molecular structure of these hydrocarbons, that is, the way carbon and hydrogen atoms are tied together in the molecule, is the determining factor in a fuel's resistance to ignition."

The principal conclusion to be drawn from the foregoing is that the delay period is the most important factor governing the smoothness of a Diesel engine, and that it depends only on two points: namely, the temperature available in the combustion chamber at the beginning of injection and the self-ignition characteristics of the fuel which will be dealt with later.

Spontaneous and Controlled Combustion.—The second stage of the combustion process, that of spontaneous combustion, is initiated with the self-ignition of a nucleus of fuel drops in the zone most favorable for this purpose and spreads immediately over the combustion chamber as far as a combustible mixture of fuel and oxygen exists. For this stage, the fuel-drop size and the air movement are of vital importance, together with the proportion of the total fuel-charge present in the combustion chamber at this time, they determine the angle of pressure rise during this period.

Little need be said about the third stage of controlled combustion, when the fuel burns immediately on leaving the nozzle. Here, the combustion pressure can be controlled directly by the rate of injection which, in turn, depends on the design of the fuel cam and its correlation with the fuel-ignition valve. This, of course, remains true only as long as sufficient oxygen for complete combustion can be supplied for the fuel.

Chemical Characteristics of the Fuel.—All oil-engine fuels are hetrogeneous mixtures of a large number of hydrocarbons, each of which has its different chemical composition and its particular molecular structure. The important fact for the purposes of this paper is that the molecular structure of these hydrocarbons, that is, the way carbon and hydrogen atoms are tied together in the molecule, is the determining factor in a fuel's resistance to ignition. The four groups of hydrocarbons present in oil-engine fuels are the paraffins, the olefins, the naphthenes and the aromatics.

In the paraffins and olefins, the C and H atoms are loosely connected in the form of a chain which can be easily broken by the heat and thus made to combine with oxygen; therefore, these two groups have a low resistance to ignition and consequently a short delay-period in a compression-ignition engine.

In the aromatic molecule, the C and H atoms form a closed ring, braced inside, which offers a large resistance to their decomposition by heat. This structure makes fuels of this nature have a long delay-period in an engine. The molecular structure of the naphthenes ranges in between the paraffins and the aromatics, as does their delay period. As a rule, however, they range much closer to the paraffins and olefins than to the aromatics. While the foregoing distinction applies to a large majority of hydrocarbons, it is not true in all cases. There are certain paraffins of a high thermal stability which means a long delay-period, while on the other hand certain naphthenes may have a weak molecular structure and, consequently, a shorter delay-period than many paraffins. American oil-engine fuels distilled from crude petroleum consist of a combination of these four groups, with the paraffins usually predominating. Depending on the type of crude, there are large variations possible in the percentage of each group, a fact which explains the large differences in the behavior of such fuels in the engine. In the distillates of coal tar such as tar oil, the aromatic group forms the largest proportion.

Such aromatic fuels have been successfully used in slow-speed Diesel-engines principally of the air-injection type in which the compression was carried higher than usual, or which employed a special pilot injection of a paraffin-base fuel. The high resistance to ignition of the aromatics would result in a very long delay-period in a high-speed Diesel-engine, a fact which makes them unsuited for this purpose. Aromatic fuels, however, can be advantageously used in another type of high-speed oil-engine which will be discussed later.

If we except a group of synthetic fuel-oils produced by modern high-pressure cracking-processes it can be said that, in most Diesel fuels of low or medium viscosity on the American market today, the proportion of aromatics and naphthenes is low enough to make them suitable for a modern high-speed Diesel-engine. The term "modern" is meant to imply that all factors now known to reduce the delay period have been applied to its design.

Physical Properties

Present-day fuel-oil specifications usually refer to their various physical properties. The principal physical properties are discussed as follows with regard to their practical importance to the user.

Specific Gravity.—This physical property, usually measured in degrees Baumé, A. P. I., or as specific gravity in relation to the same volume of water, is perhaps the most commonly specified. In the absence of a better one, it has become the engine buyer's most relied-on guide as to the suitability of a certain engine fuel.

As Dr. P. H. Schweitzer[7] points out, there exists a fair degree of correlation between the specific gravity, the flash point, the spontaneous-ignition temperature and the carbon-hydrogen ratio of a fuel. In spite of this fact, however, anyone experienced with the selection of oil-engine fuels knows that he will be often misguided by relying on this property alone. The important fact for the engine designer and operator to recognize is that no true relation can be established between specific gravity and delay period.

Flash Point.—This is the lowest temperature measured in various types of apparatus at which a fuel will ignite when

[7] See *Transactions of the American Society of Mechanical Engineers*, vol. 54, June, 1932, OGP-4-72; Combustion Knock in Diesel Engines, by P. H. Schweitzer.

a flame is passed over it. It is an indication of the fire hazard involved with the storage of fuels, but it has no meaning in regard to engine performance.

Viscosity.—This property, measured in Saybolt Universal seconds or as kinematic viscosity, is very important for the correct judgment of a fuel's suitability for an injection engine. With a given injection pressure and nozzle design, the drop size of the fuel spray increases with the fuel's viscosity, thus resulting in a slower rate of burning. At the same time an increase of drop size will make the fuel spray penetrate farther into the combustion chamber. As combustion chambers are small in automotive designs, high viscosity may cause the fuel spray to hit cool combustion-chamber walls and thus cause incomplete combustion and smoky exhaust. The size of the fuel lines, as well as the type of injection pump and injection valve, also impose limitations on the fuel viscosity. The high limit is set by the increasing resistance of the fuel to flow in sufficient volume at winter temperatures through fuel lines of small diameter. A low, useful limit on viscosity will be found in the fact that the fuel's lubrication value usually decreases with decreasing viscosity. Fuels with a viscosity lower than 40 U.S. Saybolt sec. at 70 deg. fahr. will not only cause an excessive increase of the leak past pump plungers and injecter needles, thus disturbing the injection characteristics, but will also accelerate their wear. In extreme cases, a very low fuel-viscosity may result in sticking and galling of plungers and spray needles. In spite of its importance for the reasons given above, viscosity has no influence on the delay period of any fuel.

Spontaneous-Ignition Temperature (S. I. T.).—Although the procedure to determine the spontaneous or self-ignition temperature for fuels has not been standardized as yet, it has been referred to often as the best indicator of a fuel's behavior in an engine. It is usually measured in the Moore apparatus and designates the lowest temperature at which a fuel drop will self-ignite in a stream of oxygen at atmospheric pressure. While it is admitted that, of all physical properties, the S. I. T. comes the closest to predicting the delay period a fuel will have in an engine, it is far from being an accurate indicator. The S. I. T. of oil-engine fuels usually decreases with the increase of pressure; hence, in an engine, this figure is actually quite different from the one established in the testing apparatus. If this decrease of the S. I. T. with increasing pressures were at the same rate with all fuels, this fact would not diminish the usefulness of the S. I. T. for our purposes. Tausz and Schulte[8], however, have proved experimentally that such a relation does not exist, and that large variations are possible between the S. I. Ts. of two fuels when tested at various pressures.

Volatility.—About 1907, P. Rieppel[9] established the theory that a fuel injected into a Diesel engine must evaporate and form oil gases before it can ignite, a theory which was generally accepted. This is probably the reason why volatility of a fuel has been believed for such a long time to have an important bearing on the delay period. As mentioned before, later researches have proved conclusively that the oil vapor and gas formation in an engine before ignition is negligible, and does not measurably influence the delay period. In contrast to the S. I. T., which drops with an increase of pressure, the boiling point of all liquids increases with the pressure. For this reason, a fuel's volatility taken alone does not permit one to draw any conclusions as to its behavior during the ignition and the combustion processes.

An interesting suggestion was offered by Dicksee[10], who draws from a series of experiments the conclusion that it is the relationship between the distillation curve or rather the final boiling-point and the S. I. T. which determines a fuel's suitability in regard to smoothness of operation. While these experiments bear out the fact that this theory comes closer to being a more satisfactory solution of the problem than does any other suggestion offered thus far in regard to physical properties, even among the limited number of fuels tested by this author, there was one fuel which did not fit into the picture. It is difficult to judge a fuel's suitability by its physical properties obtained at atmospheric pressures when both properties change substantially with the operating conditions of the engine.

"The four groups of hydrocarbons present in oil-engine fuels are the paraffins, the olefins, the naphthenes and the aromatics."

* * * *

"The Diesel engine in general is not as sensitive in regard to variations in fuel characteristics as is the carbureter engine and, for this reason, it probably will not be necessary that the Diesel knock-rating procedure develop the same degree of accuracy as is obtained with the C.F.R. octane rating for carbureter fuels."

* * * *

"There is little justification for a highly differentiated system of Diesel fuel-rating requiring sensitive and complicated equipment and procedure if a solution satisfactory to the Diesel industry can be secured by simpler means."

Smooth Engine-Performance Important

This brief discussion of the principal physical properties of oil-engine fuel is presented with the intention of showing that none of them, alone or combined, offer possibilities of becoming an accurate measure for a fuel's delay period in high-speed oil-engines. The knowledge of the various physical properties is necessary to make a proper selection, but they do not conclusively answer the most important question: Will the fuel give smooth engine-performance?

Physical properties so far have served as a guide in this respect only because there was no better way known. Backed by a long practical experience, engineers have been able to estimate a fuel's smoothness with a degree of accuracy fair enough for slow-speed engines; but, at that, it was more of a guess than a conclusion based upon scientific facts. With the coming of the automotive Diesel-engine and its higher sensitiveness to the delay periods of fuels, this method of

[8] See *Zeitschrift des Vereines Deutscher Ingenieure*, vol. 68, 1924, pp. 574-578; Ueber Zuendpunkte und Verbrennungsvorgaenge im Dieselmotor, by Tausz and Schulte.

[9] See *Zeitschrift des Vereines Deutscher Ingenieure*, vol. 51, 1907, pp. 613-618; Versuche ueber die Verwendung von Teeroelen zum Betrieb des Dieselmotors, by P. Rieppel.

[10] See *The Automobile Engineer*, vol. 22, June, 1932, pp. 285-291 and July, 1932, pp. 333-338; High-Speed Compression-Ignition Engines, by C. B. Dicksee.

estimating its suitability has become altogether unsatisfactory for the selection and specification of proper fuels.

During the last few years, a new group of fuel oils has appeared on the market which are usually referred to as synthetic or cracked fuels. While little information is obtainable from their producers as to the process of manufacturing, it is known that they are produced by high-pressure cracking-processes. These fuels can be readily distinguished from distilled fuels by their unusually low viscosity combined with a high specific-gravity and carbon-hydrogen ratio. Synthetic fuels of this type contain a much higher percentage of aromatics than do the conventional fuels distilled from American crudes, a fact which accounts for their high ignition-resistance in the engine. Their long delay-period and consequent "knocking" make them unsuited for high-speed Diesel-engines.

A new type of automotive oil-engine, however, has made its appearance during the last few years, for which fuels of a high content of aromatics take the same place that premium gasolines now occupy for the carbureter engines. This engine type, which was developed by K. J. E. Hesselman in Sweden, works with a compression only slightly higher than that of a modern carbureter engine. The fuel is injected into the combustion chamber in the conventional way, but is ignited by an electric spark. For obvious reasons, the delay-period problem does not exist here as the ignition of the fuel takes place in the same way as in carbureter engines. Therefore, the Hesselman engine's reaction toward fuels is identical with that of the carbureter engine which, in contrast with the compression-ignition engine, will run more smoothly with an increase of the fuel's thermal stability. The fact that, during the last year, probably more automotive engines of this new design have been produced in this country than all automotive Diesel-engines combined shows that it has passed its experimental stage. While it is outside the scope of this paper to discuss its design, it can be stated here that one of its advantages is the ability to operate on synthetic fuels as well as on others of an aromatic type which are unsuited for automotive Diesel-engines.

Practical Methods for Oil-Engine-Fuel Knock-Rating

Two practical methods suitable for a standard fuel-oil knock-rating have been suggested thus far. In several papers on this subject presented by Boerlage and Broeze[11], the authors report that they determined the delay period of fuel oils by means of an optical indicator. They also rated these fuels in their relation to a reference fuel of known delay-angle, consisting of a mixture of two hydrocarbons, cetene and mesitylene. Cetene is a hydrocarbon of a very low thermal-stability, while mesitylene has a very high thermal-stability which gives a long delay-period. The percentage of cetene in mesitylene indicates the "cetene number," a scale which is similar to the "octane number" now universally used for carbureter fuels. Confusion may arise from the fact that an increasing cetene number indicates a decreasing thermal stability, while an increasing octane number corresponds to an increasing thermal stability. It must be emphasized, however, that the requirements for a fuel's thermal stability for Diesel engines are just opposite from those for carbureter engines. For this reason an increasing cetene number of a fuel indicates smoother operation in Diesel engines, just as an increasing octane number of a fuel means smoother performance in carbureter engines.

Another proposal for a fuel-oil knock-rating was submitted in a paper by Pope and Murdock[12]. Their experiments were made with a C.F.R. variable-compression engine on which the necessary equipment for fuel injection had been installed together with a special piston, giving a combustion chamber with compression ratios suitable for compression-ignition. All factors which affect the fuel ignition were held constant, such as engine speed, water, inlet air and lubricating-oil temperatures, as well as injection pressure, timing and quantity. A "critical compression-ratio" was determined under such conditions for each fuel, representing the lowest compression-ratio at which audible combustion of the fuel could be obtained during a limited number of injections.

At first view, the method suggested by Boerlage and Broeze seems preferable to that of Pope and Murdock because the first named measure the delay period directly at compression ratios practical for Diesel engines. The method suggested by Pope and Murdock only determines a self-ignition limit at compression ratios far below those required for Diesel operation. It is obvious that at the critical compression-ratios found by Pope and Murdock, the delay period is much longer than permissible even in slow-speed engines. These objections, however, lose their importance in view of the fact that the results obtained by both methods are practically identical. A large number of fuel oils have been classified in regard to their knocking tendencies in Diesel engines by the critical-compression-ratio method and, thus far, no case has been reported where this classification did not fully agree with the results obtained in actual Diesel operation.

Elimination of Engine Variables

Other disadvantages have been cited by investigators against the critical-compression-ratio method. It is a fact that combustion at very low compression-ratios is likely to be incomplete even if the fuel injected per cycle corresponds to a low brake mean effective pressure. Under those conditions there is a possibility that fuel and carbon deposits will form in the combustion chamber which, in turn, will affect the reproducibility of the tests. It is obvious, however, that with the 3-sec. time-limit for injection suggested by Pope and Murdock, these deposits cannot grow to serious proportions, especially if after a series of tests the engine is operated at its own power and at a high compression-ratio for a short time so that these deposits will burn out. The influence of these and other possible engine variables can be eliminated by matching the fuel to be tested against reference fuels of known rating such as those suggested by Boerlage and Broeze.

The great advantage of using the C.F.R. engine for Diesel fuel-rating lies in the fact that this engine and method are simple to operate; that the C.F.R. engine has now been universally accepted for knock ratings of carbureter fuels and can be found in every important liquid-fuel research-laboratory of the world. The cost of the additional equipment required for compression-ignition fuel-testing is only a fraction of the cost for a complete unit for such purposes. No sensitive diagram-indicator or other delicate instruments are needed.

Tests reported and published by either method up to the present are not extensive enough to judge conclusively which

[11] See *Engineering*, vol. 132, Nov. 13, 1931, pp. 603-606, Dec. 4, 1931, pp. 687-689, and Dec. 18, 1931, pp. 755-756; The Ignition Quality of Fuels in Compression-Ignition Engines, by G. D. Boerlage and J. J. Broeze. See also S.A.E. JOURNAL, July, 1932, pp. 283-293; Ignition Quality of Diesel Fuels as Expressed in Cetene Numbers, by G. D. Boerlage and J. J. Broeze.

[12] See S.A.E. JOURNAL, March, 1932, pp. 136-142; Compression-Ignition Characteristics of Injection-Engine Fuels, by A. W. Pope, Jr. and J. A. Murdock.

of them is best suited for practical application. Very possibly a combination of the best features of both methods may lead to a final solution. As stated before, the Diesel engine in general is not as sensitive in regard to variations in fuel characteristics as is the carbureter engine, and for this reason it probably will not be necessary that the Diesel knock-rating procedure develop the same degree of accuracy as is obtained with the C.F.R. octane rating for carbureter fuels. There is little justification for a highly differentiated system of Diesel fuel-rating requiring sensitive and complicated equipment and procedure, if a solution satisfactory to the Diesel industry can be secured by simpler means.

Besides the research work of the Royal Dutch Shell Co. and the Waukesha Motor Co. as represented by the papers of Boerlage and Broeze and of Pope and Murdock, a number of concerns here and abroad are now experimenting in this field. It would be highly desirable to have the results of these tests published, or at least put at the disposition of the joint S.A.E. and A.S.M.E. Diesel Fuel-Research Committee. The suggestion is submitted that, once a method for standard Diesel-fuel knock-rating has been established, a standard for Diesel fuel-specifications be set also, covering the following properties:

(1) Standard knock rating, being an indicator for the delay period and combustion smoothness to be expected.

(2) Gravity, preferably expressed as specific gravity instead of the present expression in degrees Baumé or A. P. I. This would simplify conversion calculations from weight to volume.

(3) Viscosity, in Saybolt Universal seconds, at 70 deg. fahr.

(4) Pour point in degrees fahrenheit. This physical property will be essential for automotive Diesel installations operating at low surrounding temperatures.

(5) Conradson carbon.

(6) Water and sediment.

(7) Sulphur content.

The last three items have an important influence on the wear and depreciation of the engine, as well as on the carbon formation in the combustion chamber.

The Heat Treatment of Gearing

WHEN we apply the term "heat treatment" we usually refer to the operations of carburizing, hardening and tempering after the parts are machined. However, the heat treatment of gears really begins from the time the scrap, lime and ore are dumped into the open hearth or electric furnace and continue through all the subsequent metallurgical processes of casting, ingot heating and rolling, billet heating, forging, normalizing and annealing.

The type of scrap, melting, the fusion, the processes of oxidation and reduction, the temperature of pouring, the interval between pouring and casting and the type of mold are all factors in the finished product. The omission or addition of certain dosages of manganese, aluminum or vanadium in the ladle may determine how gear steel will machine or distort in the final hardening, by making it either fine grained or coarse grained. The presence or absence of non-metallics may affect cutter life. The temperature of rolling, the amount of reduction from the ingot to the bar and even the rate of cooling of the bars may affect the quality of gears.

Forging consists of heating the steel to a plastic condition whereby it may be made to flow and fill a concavity in dies of the desired contour. This is done by board or steam hammers, presses or upsetting machines. The material as furnished to the steel mill is in the form of bars or slabs. We can forge this with little disturbance of the flow lines in the original bar, or we can orient these lines by upsetting in an upsetter direct from the bar or segment, or we can cut off slugs, up end them and orient the grain in a board or steam hammer. Since a gear is round in shape an orientation of the fibers radially is very desirable.

Gear teeth are subject to fatigue and impact strains and the resistance to these stresses is greatest at right angles to the fiber than parallel to it. A gear made of bar stock does not have the impact or fatigue value of an upset gear.

The temperature of forging is not as important as the amount of work and the finishing temperature. Steel should be forged high enough to be fully plastic to fill out the dies and make sharp-cornered forgings. It is obvious that large forgings, such as crankshafts, must be heated hotter than an idler-gear forging. The finishing temperatures should be about 1700 deg. fahr.

The cluster gear is one of the most difficult gear forgings to make correctly. After a forging is once coarsened by heat, it is difficult to normalize and reduce the grain size materially. Quick heats are better than slow prolonged heat, for the element of time also enters into grain coarsening.

After the forging operation gear forgings should be normalized. Gears annealed but not normalized always show more movement in the final hardening operation than gears which are both normalized and annealed. In fact, all our researches into the cause of gear distortion have shown that lack of correct normalizing is one of the principal causes of gear noise. Normalizing is conducted at temperatures from 1700 to 1850 deg. fahr. and consists of bringing the gears up to temperature, holding for one to two hours at heat and then cooling at a fairly fast rate to prevent abnormal grain growth.

Annealing is a separate operation from normalizing. It does not consist of merely softening the steel so that it can be machined but is a highly developed metallurgical science involving all the available knowledge of micro constituents and metallography. Each type of steel must be annealed to some definite micro pattern if the maximum machining results are to be obtained.

The carburizing operation consists of impregnating the surface of the steel with carbon, for which it has an affinity when the steel is heated. The depth of this penetration will vary from 1/64 in. to ⅛ in., depending on the time and temperature at the carburizing heat, which is usually within the range of 1650 to 1750 deg. fahr.

The operation of hardening a gear always produces internal change in the steel. The slogan of the gear cutter when he is confronted with noisy gears has always been "They distorted in the fire" and this is no myth. As a general thing the lower the hardening temperature the less will be the distortion.

Excerpts from a paper presented at meeting of the American Gear Manufacturers Association, Wilkinsburg, Pa., May 5, 1933, by E. F. Davis, Metallurgist, Warner Gear Co.

Scavenging by Large Valve-Overlap Increases Power and Economy

By Oscar W. Schey

Associate Mechanical Engineer, National Advisory Committee for Aeronautics

SINCE the power output of an engine is practically proportional to the weight of the charge, the object has been to increase the weight of the charge burned. The weight of charge inducted by an aircraft engine and the supercharger power required to supply this charge depend among other factors upon how completely the engine is scavenged.

In the conventional four-stroke-cycle engine only the exhaust gases in the displacement volume are forced out of the cylinder by the piston on the exhaust stroke; consequently, the engine cannot induct a charge of greater volume than that of the displacement volume, whereas if the clearance volume could be scavenged also, the engine could induct a charge equal to the displacement plus the clearance volume.

A description of the equipment used for conducting a series of tests to determine the performance of an engine that was completely scavenged as compared with one having only the displacement volume scavenged is given by the author, who explains also the method and scope of the investigation and discusses the test results. Curves are presented which resulted from the test data obtained. The mechanical considerations which pertained during the tests are presented and commented upon, and three conclusions are stated.

DURING the last decade we have seen the universal acceptance of the forced induction of air by means of a supercharger as the most satisfactory method for obtaining a high power-output from aircraft engines. The object has been to increase the weight of the charge burned, the power output being practically proportional to the weight of the charge. It is important that the supercharger be used efficiently for this service in order that its power requirements may be only a small part of the gain in engine power.

The weight of charge inducted by an engine and the supercharger power required to supply this charge depend among other factors upon how completely the engine is scavenged. In the conventional four-stroke-cycle engine, only the exhaust gases in the displacement volume are forced out of the cylinder by the piston on the exhaust stroke. Consequently, the engine cannot induct a charge of greater volume than that of the displacement volume; whereas, if the clearance volume could be scavenged also, the engine could induct a charge equal to the displacement plus the clearance volume. The ratio of the engine power with complete scavenging to that with normal scavenging should be equal to the ratio of the volumes of the charge or $r/(r-1)$ where r is the compression ratio. For a compression ratio of 5.0, the ratio of the volumes for the two conditions would be 1.25.

To obtain an increase in charge weight of 25 per cent for a conventional engine at sea level would require an increase in the carbureter pressure of approximately 7 in. of mercury and a corresponding increase in the supercharger power. If the exhaust gases from the clearance volume could be removed by some simple method requiring little pressure-difference across the intake and the exhaust valves, then the engine power could be increased greatly at practically no cost in supercharger power. The superchargers now in use on aircraft engines also could be used as scavenging blowers, without complicating the engine induction system. The valve timing of the engine would have to be changed so that both the intake and the exhaust valves are open during the last part of the scavenging stroke and the first part of the intake stroke. The dead gases would be blown out of the combustion chamber when they occupy the minimum volume.

The conditions are ideal in a four-stroke-cycle engine for the removal of all the dead gases with the minimum wasting of fresh air by using a large valve-overlap and a small differ-

[This paper was presented at the April 5-7, 1932, Aeronautic Meeting of the Society. The engine was equipped also for fuel injection and the scavenging was by means of large valve-overlap.]

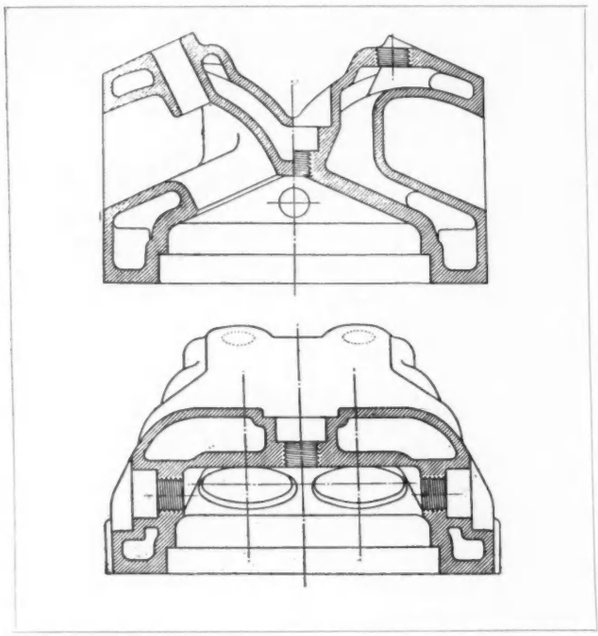


Fig. 1—Type of Combustion Chamber Used in the Tests

ence in pressure between the intake and the exhaust. A large increase in charge weight can be obtained at practically no cost in supercharging power. The carbureter could be replaced with a fuel-injection system so that the time of injection of the fuel could be controlled. It undoubtedly would be impossible to scavenge appreciably and to boost an engine equipped with a conventional carbureter without carrying some of the fuel out through the exhaust.

Description of Equipment.—The National Advisory Committee for Aeronautics has conducted a series of tests to determine the performance of an engine that was completely scavenged as compared with one having only the displacement volume scavenged. The N.A.C.A. single-cylinder universal test-engine was used in these tests[1]. This engine has a 5-in. bore and 7-in. stroke and is constructed so that the valve timing, valve lift and compression ratio can be changed while the engine is running, making it particularly suitable for these tests. The cylinder head is a pent-roof type as shown in Fig. 1. It is fitted with two intake and two exhaust valves of 1 15/16-in. diameter. Holes are provided in the head for three spark plugs. In these tests the injection nozzle was used in the top hole, centrally located with respect to the four valves, and spark plugs were used in each of the two side holes between the intake and the exhaust valves. When an indicator was used, the engine was operated with only one spark plug. The cams were constructed so that the time of opening and closing of any valve could be changed by varying the dwell of the cam. The engine was connected to an electric dynamometer equipped with scales for measuring the engine torque.

A Compur cam-operated plunger-type pump was used for supplying the fuel. It was driven from the engine crankshaft through a 2-to-1 reduction gear which also served as a timing mechanism. A spring-loaded automatic injection-valve set to open at a pressure of 3000 lb. per sq. in. was used for injecting the fuel, as shown in Fig. 2. The nozzle of the injection valve had seven orifices located to give a spray in a plane parallel to the crankshaft. This injection valve and nozzle were selected after several types had been tried.

A Roots-type supercharger driven by an electric motor supplied air at the desired scavenging and boost pressure. Two large tanks were interposed in the air duct between the engine and the supercharger to damp air pulsations from the engine. The carbureter used with this engine was left in place and its throttles were used to control the air supply for starting.

Method and Scope of the Investigation.—The torque at the dynamometer was read directly from the dial scales, and the fuel consumption and engine speed were determined from the readings of an electrically operated counter and stop watch, which were connected to the fuel scales and gave the time and the number of engine revolutions required to use a given weight of fuel. For all conditions for which the fuel consumption was desired, a series of at least three runs was made with fuel-air ratios varying from slightly richer than necessary for maximum power to lean enough to cause a decided drop in power. The ignition timing was set for maximum power for each compression ratio and boost pressure, except that when operating with the 8.5 compression ratio it was necessary to retard the ignition because of detonation. The indicator cards were taken with a modified Farnboro electric indicator[2]. All power measurements were corrected to a standard temperature of 59 deg. fahr. and a standard barometric pressure of 29.92 in. of mercury, the power being considered to vary inversely as the square root of the absolute temperature and directly as the barometric pressure.

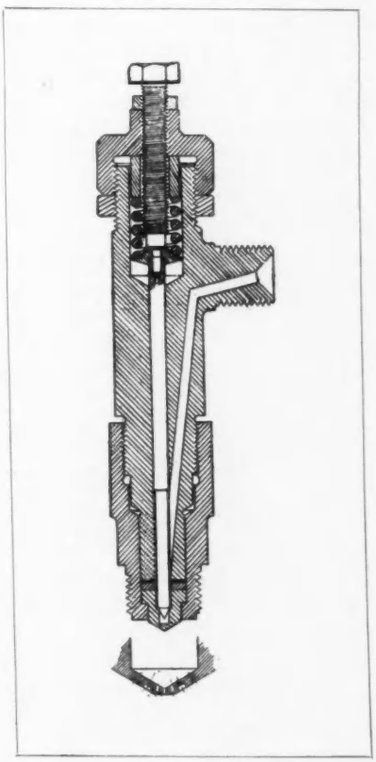


Fig. 2—Spring Loaded Automatic Injection-Valve. Enlarged Section of Nozzle Shown Below.

[1] See N.A.C.A. 1927 Technical Report No. 250: Description of the N.A.C.A. Universal Test Engine and Some Test Results, by Ware and Marsden.

[2] See N.A.C.A. 1930 Technical Note No. 348: Alterations and Tests of the Farnboro Engine Indicator, by John H. Collins, Jr.

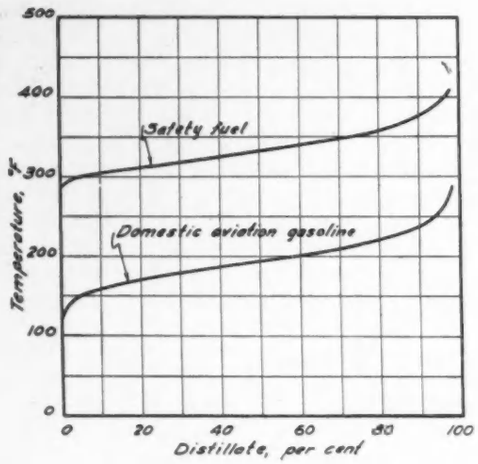


Fig. 3 *(Above)*—**Distillation Curves for the Domestic Aviation Gasoline and the Safety Fuel.**

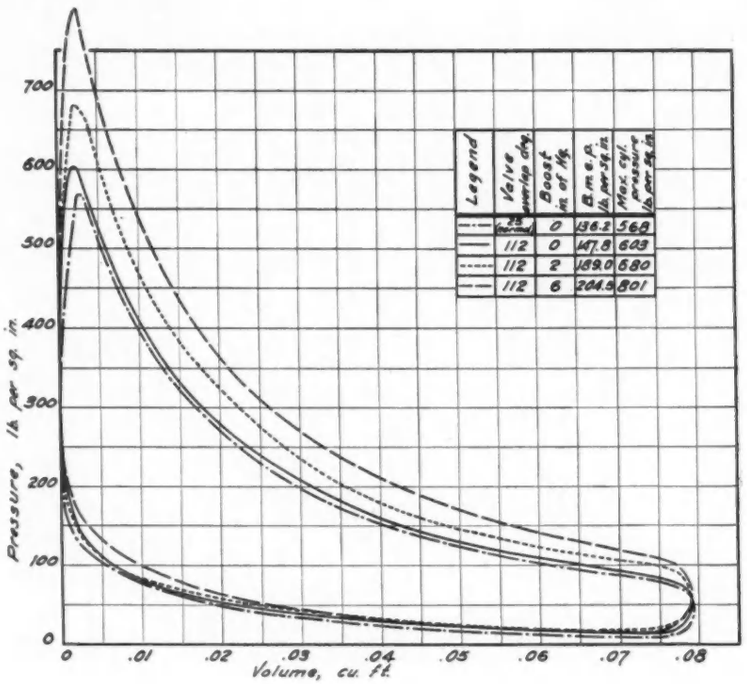


Fig. 5 *(Right)*—**Pressure-Volume Diagrams for Several Operating Conditions at 5.5 Compression Ratio**

Before the tests herein reported were conducted, the valve lift was set at ⅜ in. and numerous runs were made to determine the best valve-timing. The settings finally decided upon were as follows: inlet opens 60 deg. before top center; inlet closes 27 deg. after bottom center; exhaust opens 47 deg. before bottom center; and exhaust closes 52 deg. after top center. The events occurring at the bottom of the stroke probably were not timed quite as well as was possible, for they were at the limit of their adjustment; but, from other valve-timing data recently published by the Committee[3], it seems probable that they were not displaced far enough from their optimum positions to affect the engine power appreciably. With this valve timing, which gave 112 deg. overlap, the events at the top of the stroke were approximately at their best position.

Tests were conducted to determine the full-throttle performance at 1500 r.p.m. for the conditions of valve timing, intake pressure, compression ratio, fuel and fuel system given in Table 1. In these tests the water-out temperatures were kept at 160 deg. fahr. and the oil-out temperatures at 140 deg. fahr.

The gasoline used in these tests had an octane number of at least 73 before adding any ethyl fluid. The safety fuel used was the new hydrogenated fuel developed by the Standard Oil Co. (N. J.). It had a flash point of 105 to 110 deg. fahr. as compared with —10 deg. fahr. for the gasoline. The atmospheric distillation-curves for the two fuels are shown in Fig. 3.

Test Results.—Fig. 4 shows the brake mean effective pressure and the specific fuel consumption obtained with different degrees of boost with a fuel-injection system and with a carbureter when the engine is operated with a large valve-overlap. Similar performance data are also shown for this engine with a carbureter when using standard Liberty timing

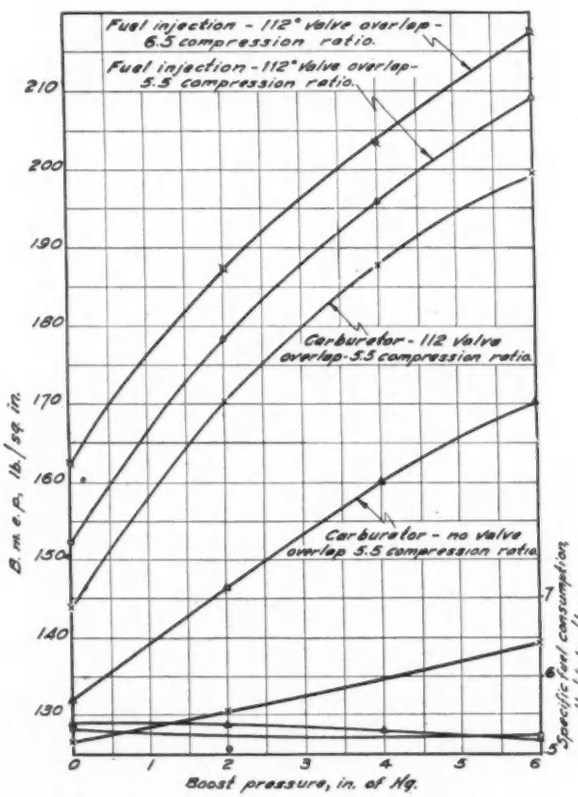


Fig. 4—Curves Showing Brake Mean Effective Pressure and Specific Fuel Consumption with 112-Deg. Valve-Overlap for Both Fuel Injection and Carbureter Operation, and without Overlap when Using the Carbureter

[3] See N.A.C.A. 1931 Technical Report No. 390: The Effect of Valve Timing upon the Performance of a Supercharged Engine at Altitude and an Unsupercharged Engine at Sea Level, by Oscar W. Schey and Arnold E. Biermann.

Table 1—Various Conditions Investigated

Condition No.	Valve Overlap, Deg.	Intake Pressure	Compression Ratio	Kind of Fuel	Fuel System
1	112 and No overlap	Atmospheric to 6 in. of Hg.	5.5	(D.A.G.)[a] plus 10 Cc. of Ethyl Fluid per Gal.	Carbureter
2	112	Atmospheric to 6 in. of Hg.	5.5 and 6.5	(D.A.G.)[a] plus 10 Cc. of Ethyl Fluid per Gal.	Injection
3	112	Atmospheric and 2 in. of Hg.	5.5, 6.5, 7.5 and 8.5	(D.A.G.)[a] plus 10 Cc. of Ethyl Fluid per Gal.	Injection
4	112	Atmospheric	5.5 and 6.5	(D.A.G.)[a] without Ethyl Fluid and (D.A.G.)[a] plus 10 Cc. of Ethyl Fluid per Gal.	Injection
5	112	Atmospheric and 2 in. of Hg.	5.0, 5.5 and 6.0	Safety Fuel	Injection
6	25[b]	Atmospheric	5.0, 5.5 and 6.0	Safety Fuel	Injection
7	25[b]	Atmospheric	5.0, 5.5 and 6.0	(D.A.G.)[a]	Carbureter
8	112	Atmospheric	5.0, 5.5 and 6.0	(D.A.G.)[a]	Injection

[a] Domestic Aviation Gasoline.
[b] Normal Timing.

or no valve overlap. No correction has been applied to any of the data presented for the power required to drive the supercharger. This correction would amount to about 2 per cent of the total engine power at a pressure of 2 in. of mercury and about 5 per cent at a pressure of 6 in. of mercury. These values are based on a supercharger having an overall adiabatic efficiency of 70 per cent.

It is reasonable to assume that some improvement in scavenging must be obtained with a large valve-overlap even with no boost pressure, or there would not be so great a difference between the brake mean effective pressure with no overlap and that with a valve overlap. For the conditions using a large valve-overlap, the brake mean effective pressure at first increases with boosting at a much greater rate than with no valve overlap. It should be noted that, at a compression ratio of 6.5 with a boost pressure of only 6 in. of mercury, a brake mean effective pressure of 217 lb. per sq. in. is obtained, with a fuel economy of 0.52 lb. per b.hp-hr.

Pressure-Difference Considerations

For a pressure difference between the inlet and the exhaust of more than 4 or 5 in. of mercury, the point where the curves indicate that the engine is probably completely scavenged, the rate of increase in brake mean effective pressure with an increase in boost pressure should be the same with either valve timing, with the actual values for the scavenged engine higher by a constant amount depending on the compression ratio. In these tests the fuel-injection system gave a brake mean effective pressure of approximately 10 lb. per sq. in. more than the carbureter. It may be well to mention that the induction system is not entirely satisfactory for carbureter operation; therefore, the difference on another engine may not be as great as these results indicate. Neglecting the power required to drive the supercharger, the specific fuel-consumption for a carbureted engine with no valve overlap and for a fuel-injection engine with a valve overlap decreases slightly with an increase in boost pressure; whereas, the fuel consumption for a carbureted engine with a large valve-

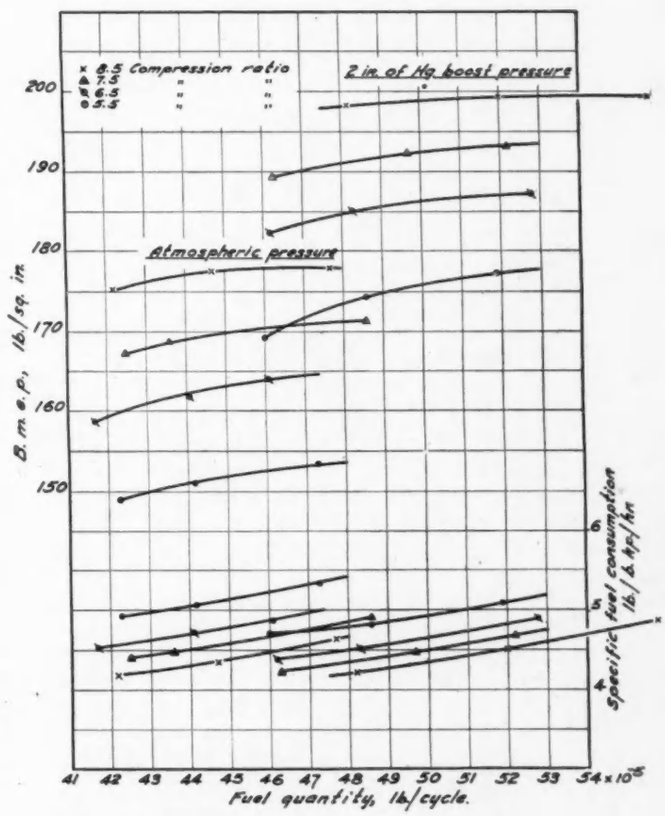


Fig. 6—Curves Showing Brake Mean Effective Pressure and Fuel Consumption with 112-Deg. Valve-Overlap, and Fuel Injection for Different Compression Ratios and Boost Pressures

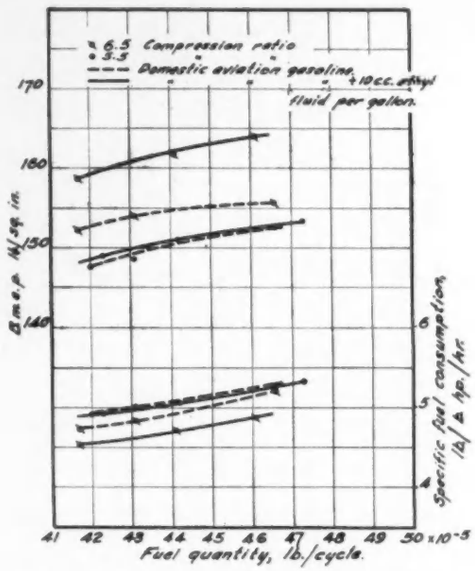


Fig. 7—Curves Showing the Effect of the Addition of 10 Cc. of Ethyl Fluid per Gal. to the Fuel, on the Brake Mean Effective Pressure and the Fuel Consumption when Operating with 112-Deg. Valve-Overlap and Fuel Injection

overlap increases with the boost pressure because some of the mixture is wasted in the scavenging process.

The indicator cards obtained with normal valve-timing and no boost pressure and with a valve overlap of 112 deg. and no boost pressure and boost pressures of 2 and 6 in. of mercury are shown in Fig. 5. The cards show that high pressures can be obtained during the entire expansion stroke when the engine is scavenged and boosted. If the compression ratio had been increased, the pressures would have been much higher in the early part of the expansion stroke and lower in the last part of the stroke. It may be well to point out that the high brake mean effective pressure obtained by boosting could not have been obtained by increasing the compression ratio without excessive cylinder pressures.

The effect of a large valve-overlap on the brake mean effective pressure and the fuel consumption at various compression ratios with fuel injection is shown by the curves in Fig. 6. These curves show that the scavenging of an engine results in a large increase in power and an appreciable improvement in fuel consumption. The actual quantity of fuel injected per cycle, however, is greater when the engine is scavenged and boosted, because the weight of air inducted is greater. It will be noted that with a more completely scavenged and boosted engine excellent economy can be obtained with exceptionally high power-output. For instance, with a mixture ratio giving maximum power at a compression ratio of 6.5 and at a boost pressure of 2 in. of mercury, a brake mean effective pressure of 187 lb. per sq. in. and a fuel consumption of 0.49 lb. per b.hp-hr. are obtained. With a mixture ratio giving 97 to 98 per cent of maximum power and other conditions the same, the fuel consumption is 0.44 lb. per b.hp-hr. Bear in mind that these results are for an engine of low mechanical efficiency and that if they had been cor-

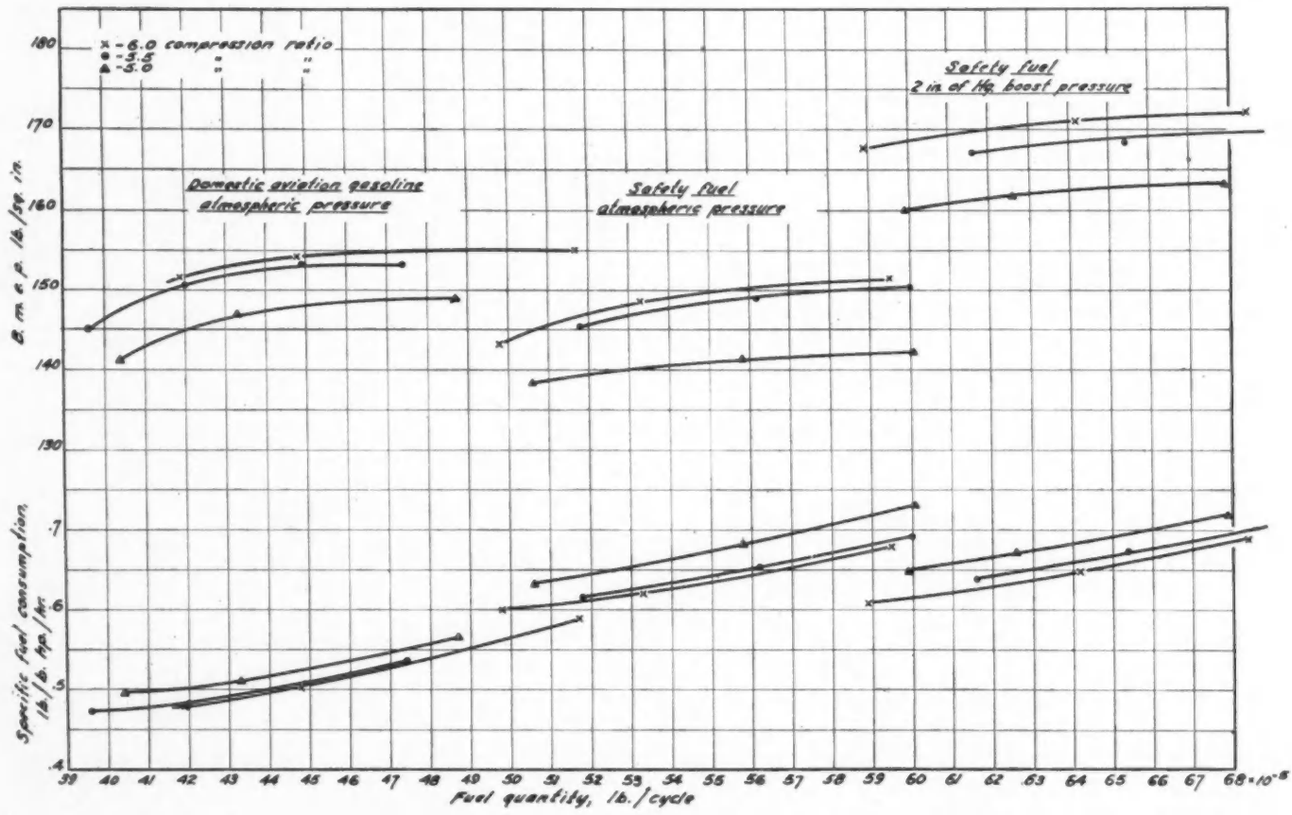


Fig. 8—Brake Mean Effective Pressures and Fuel Consumptions Obtained at Compression Ratios of 5.0, 5.5 and 6.0 with 112-Deg. Valve-Overlap When Using Domestic Aviation Gasoline at Atmospheric Intake-Pressure, Safety Fuel at Atmospheric Intake Pressure, and a Boost Pressure of 2 In. of Mercury

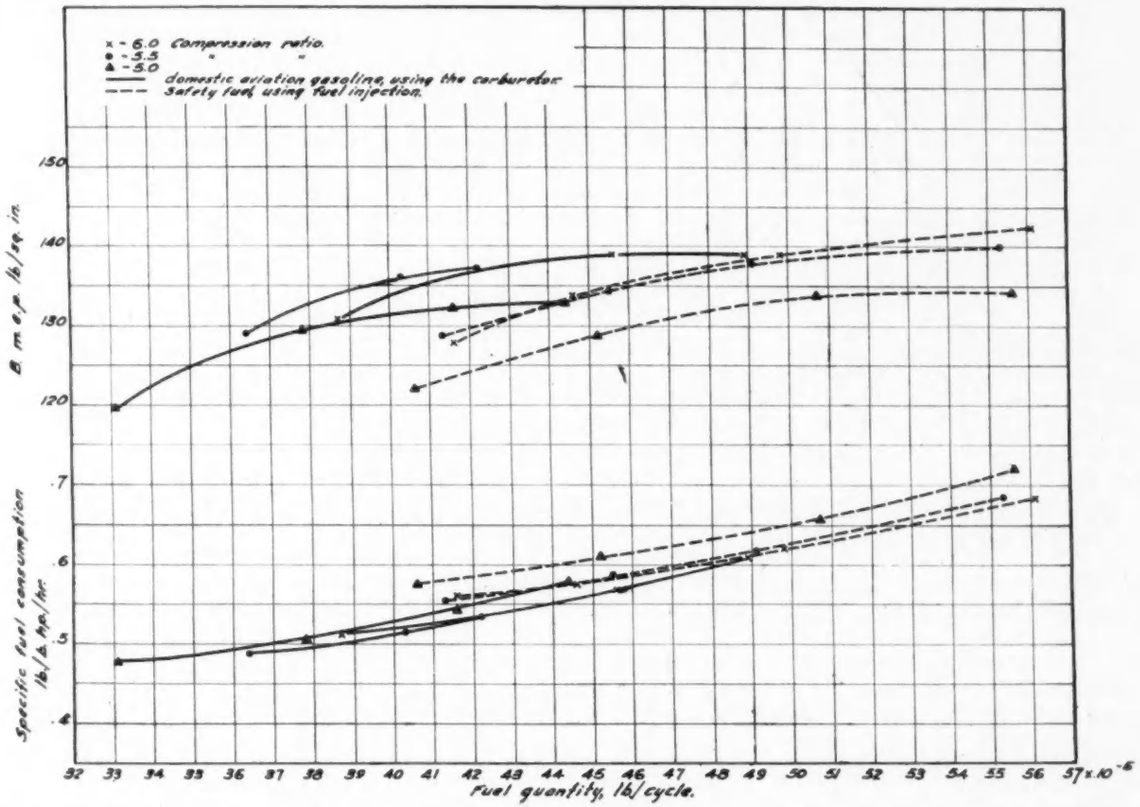


Fig. 9—Brake Mean Effective Pressures and Fuel Consumption Obtained at Compression Ratios of 5.0, 5.5 and 6.0, with 25-Deg. Valve-Overlap When Using Domestic Aviation Gasoline with the Carbureter and When Using Safety Fuel with the Fuel-Injection System

rected to the high mechanical efficiency of radial air-cooled engines, the brake mean effective pressure at the high compression-ratios with 2 in. of mercury boost would be over 200 lb. per sq. in. and the fuel consumption would be less than 0.4 lb. per b.hp-hr.

Fig. 7 shows the results obtained at compression ratios of 5.5 and 6.5 with domestic aviation gasoline compared with those obtained with domestic aviation gasoline plus 10 cc. ethyl fluid per gal. At a compression ratio of 5.5, very little difference is noted in either the fuel consumption or the power; but, at a compression ratio of 6.5, the power and the fuel consumption are considerably better with doped fuel. Although no tests were made to determine the amount that the pressure at the intake could be increased with domestic aviation gasoline without the engine detonating, it is believed that at a compression ratio of 5.5 the boost pressure could be increased at least 2 in. of mercury. There was no audible difference in the tendency to detonate with an engine having a scavenged clearance-volume as compared with one that is not scavenged.

The brake mean effective pressure and the fuel consumption obtained with safety fuel and domestic aviation gasoline, when using the fuel-injection system and operating with a valve overlap of 112 deg., are shown in Fig. 8 for compression ratios of 5.0, 5.5 and 6.0. The tests with safety fuel were made with atmospheric pressure and with a pressure of 2 in. of mercury at the intake, and the tests with domestic aviation gasoline were made with atmospheric pressure at the intake. With atmospheric pressure at the intake, the brake mean effective pressure obtained with safety fuel is slightly less than that obtained with gasoline and the fuel consumption is considerably more. There is little improvement in the performance with either fuel at a compression ratio of 6.0 as compared with that at a compression ratio of 5.5, because the spark had to be retarded to eliminate detonation. For the scavenged condition with safety fuel, the brake mean effective pressure was slightly less than that for gasoline, as shown in Fig. 6, and the fuel consumption was considerably higher. It is believed that this fuel consumption can be reduced appreciably.

Since these tests were conducted and the results submitted, the National Advisory Committee for Aeronautics has conducted further tests with safety fuel at 5.85 and 7.00 compression ratios. In the latter tests, which were conducted with a less volatile safety fuel of 95 octane number, the brake mean effective pressure obtained with safety fuel was equal to that obtained with gasoline, and the fuel consumption with safety fuel was only 4 to 5 per cent greater than with gasoline.

The curves in Fig. 9 show the brake mean effective pressure and the fuel consumption obtained with gasoline when using a carbureter and with safety fuel when using the fuel-injection system at compression ratios of 5.0, 5.5 and 6.0 at atmospheric intake pressures and with normal valve-timing. The power is slightly better with the safety fuel, but the fuel consumption is lower with the gasoline. It is interesting to note that the fuel consumption with safety fuel is better with normal valve-timing than with a large valve-overlap as shown in Fig. 8.

Mechanical Considerations.—The operation of the engine was entirely satisfactory except at idling speeds when the

carbureter throttles were used for regulating the air supply. The idling was poor with this throttle arrangement because, when the throttle was closed, the exhaust gases from the combustion chamber would flow into the intake pipe and on the following intake stroke these dead gases would be inducted into the combustion chamber. The varying amount of these dead gases present for each cycle caused the engine to idle poorly. The idling difficulty was eliminated by placing the throttle close to the intake valves. With this arrangement the engine would idle satisfactorily at a speed of 150 r.p.m. The late exhaust-closing did not affect the idling; apparently, very little air was drawn into the combustion chamber through the exhaust valve during the early part of the intake stroke.

The valve timing that is best for a supercharged engine at sea level is not necessarily the best at altitude because the pressure difference between the intake and the exhaust valve is greater. Further, the importance of using a scavenging blower decreases as the altitude increases because there is less exhaust gas in the clearance volume, the exhaust pressure being less. At an altitude of 18,000 ft. there is approximately 50 per cent by weight less exhaust gas in the clearance volume at the end of the scavenging stroke than there is at sea level; hence, the increase in power due to scavenging the engine should be only 50 per cent of what it is at sea level. Because the pressure difference between the intake and the exhaust increases with an increase in altitude on a supercharged engine, the amount of compressed air wasted would have to be considered in the timing of the engine operating at moderately low altitudes.

Use of a Turbo-Supercharger

For engines equipped with turbo-superchargers, the improvement due to scavenging would be obtained at all altitudes up to the critical altitude provided that the pressure at the intake could be maintained a few inches of mercury higher than the pressure at the exhaust. To obtain the best results with a turbo-supercharger, it may be necessary also to use a geared supercharger with a small compression ratio to give the necessary pressure difference.

The cylinder overlap must be considered also so that one cylinder does not starve another cylinder. It is believed that this difficulty with a fuel-injection system could be overcome by connecting each cylinder through a short intake into a common reservoir. The reservoir should be sufficiently large so that pressure fluctuations would not appreciably affect the charge to each cylinder. Any ramming action obtained with long inlet pipes due to the kinetic energy of the air could be compensated for by slightly increasing the pressure in the reservoir.

The results show that an appreciable improvement in performance can be obtained by the use of a large valve-overlap, even when a scavenging blower is not used. This information could be used to advantage on an unsupercharged engine equipped with a fuel-injection system. Each cylinder would be provided with separate intake and exhaust stacks; consequently, the cylinders would not interfere with each other during the inducting and the exhausting process.

The fuel-injection system is more complicated than the carbureter, but it has some important advantages. In most carbureted engines some of the cylinders receive a richer mixture than the others. This unequal distribution means that all of the mixture must be enriched until the leanest mixture any cylinder receives is not too lean. Because better distribution can be obtained with a fuel-injection system than with a carbureter, the fuel injection should be more economical and give better acceleration and smoother running. Besides eliminating the carbureter, the fuel-injection system eliminates the need for preheaters and hot spots. If the fuel is injected directly into the cylinder, the fire hazard caused by backfiring and the formation of ice in the induction system are eliminated. The use of the injection system makes possible the use of less volatile fuel, and this is a very important consideration in reducing the fire hazard.

Summary

The results of this investigation can be summarized as follows:

(1) The clearance volume of an engine can be scavenged completely by using a large valve-overlap and about a 2 to 5-in. of mercury pressure-difference across the intake and exhaust valves.

(2) Scavenging an engine by the use of a large valve-overlap results in a large increase in power and exceptionally good economy at practically no cost in supercharger power.

(3) The solid injection of a low volatile fuel gives satisfactory operation, except that the fuel consumption is high. The use of this fuel should practically eliminate crash fires.

Gear Lapping After Heat Treatment

THE technique of gear cutting has never progressed to the point where the desired accuracy for certain types of units could be consistently attained without subsequent correcting operations. Lapping has been resorted to as one of the principal means of effecting these corrections. It is important to differentiate between correction of gear teeth by the removal of an appreciable amount of stock and merely a polishing operation by which little material is removed.

After summarizing lapping methods, the author states that, with the increasing pressure of the automotive industry for silent transmissions, it has become imperative for the gear manufacturer to eliminate all errors in gear teeth to a very much higher degree than was heretofore considered necessary. These errors include profile, index, eccentricity, helical angle and quality of finish. These insistent demands for higher quality have resulted in two new lapping practices being developed within the last three years. Both are based on the use of a separate lap and a crossing of the axes of gear and lap. The first of these is known as Cramp Lapping, in which the lap tooth is given an abnormal thickness and in which the feed reduces the center distance between gear and lap. The lap teeth contact both sides of the gear tooth; cutting is by a lapping compound fed into the gears during operation.

In the second of these methods, known as Power Tail-Stock Lapping, the center distance between gear and lap remains constant and a power tail-stock is used to effect a braking action on the work gear, which is driven by the lap. After the work gear has been driven a given number of revolutions in one direction, rotation is reversed and progresses in the opposite direction a number of revolutions to complete the cycle. The brake operates throughout the continuous cycle, first in one direction and then in the other. Thus both sides of each work gear tooth are given the same amount of processing.

Excerpts from a paper presented at meeting of the American Gear Manufacturers Association, Wilkinsburg, Pa., May 6, 1933, by R. S. Drummond, president, National Broach & Machine Co.

Load-Carrying Capacity of Extreme-Pressure Lubricants

By S. A. McKee, E. A. Harrington and T. R. McKee

THE choice of a suitable lubricant for a given mechanism involves a study of the relation between the various factors of design, operation and lubricant characteristics. One of the most important phases of the extreme-pressure-lubricant problem is the development of laboratory apparatus and test methods for the determination of the characteristics of a lubricant that are significant measures of its service performance.

During the last year the U. S. Bureau of Standards has undertaken a comprehensive study of the problem of extreme-pressure lubricants in cooperation with the S.A.E. Lubricants Research Subcommittee. Since the primary requisite for an extreme-pressure lubricant is that "it lubricate under high load," it was decided that a start on this program be made with an investigation of the load-carrying capacity.

The preliminary tests are described, the effect of speed and temperature is considered, and the apparatus and procedure are explained. Following a discussion of the results, five specific conclusions are stated.

For any satisfactory apparatus, it is desirable to have the ratio of the applied load to the actual pressure remain constant throughout each run. To this end a machine is being developed at the Bureau of Standards in which this ratio will remain essentially constant during each run.

An additional feature of interest in this machine is that, not only may the speed and temperature be changed over wide limits, but also the action between the surfaces under load may be changed as desired from pure sliding to pure rolling with various intermediate steps of combined rolling and sliding.

THE general tendency in the design of modern machinery has been toward a higher ratio between power and "dead weight." This is especially true in the automotive industry and in recent years certain types of gears and other mechanisms have been developed with the operating pressures on the working surfaces so high that ordinary mineral lubricants will not provide sufficient lubrication for satisfactory operation. These mechanisms have come into use to an extent sufficient to make the problem of extreme-pressure lubricants one of considerable importance in automotive lubrication.

The factors that determine the performance characteristics of a mechanism lubricated with an extreme-pressure lubricant may conveniently be divided into three general classes; namely, design factors, operating factors and lubricant characteristics. In gears, the design factors of importance are gear dimensions, tooth design and gear material. The operating factors of interest are load, speed and temperature. The characteristics of the lubricant of most significance are load-carrying capacity, tendency to cause or prevent wear, corrosiveness and stability. The problem of the choice of a suitable lubricant for a given mechanism therefore involves a study of the relation between these various factors of design, operation and lubricant characteristics.

While performance in service is the ultimate criterion for any lubricant, previous experience in other lubricating problems has indicated the need for suitable laboratory tests for the evaluation of the lubricants. Thus one of the most important phases of the extreme-pressure-lubricant problem is the development of laboratory apparatus and test methods for the determination of the characteristics of a lubricant that are significant measures of its service performance.

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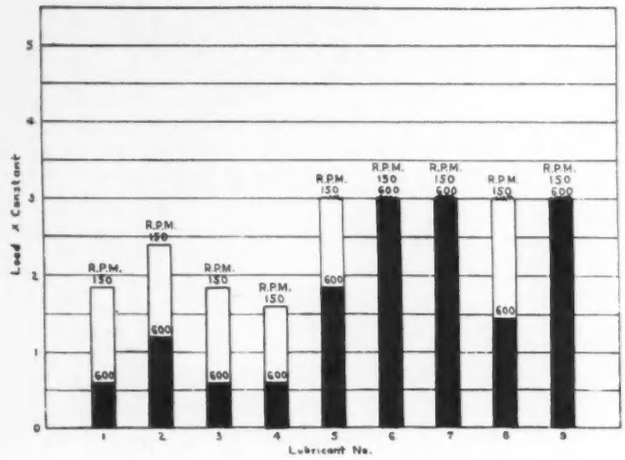

Fig. 1—Results of Tests with the Nine Lubricants on One of the Machines Operating at Speeds of 150 R.P.M. and 600 R.P.M.

During the last year the U. S. Bureau of Standards has undertaken a comprehensive study of the problem of extreme-pressure lubricants in cooperation with the S. A. E. Lubricants Research Subcommittee. Since the primary requisite for an extreme-pressure lubricant is that "it lubricate under high load," it was decided that a start on this program be made with an investigation of the load-carrying capacity.

Preliminary Tests—Several types of laboratory apparatus already have been developed for measuring the load-carrying capacity of extreme-pressure lubricants. It therefore was requested that the present investigation commence with a study of the performance of four of these machines operated under the respective test procedures recommended by the manufacturers.

For the tests with these machines, nine lubricants were chosen by the Subcommittee as being representative of the various types of extreme-pressure lubricants. One of these lubricants is a straight mineral oil (S. A. E. 70) which is used as a basis for comparison. Information as to the types of these lubricants is given in Table 1.

In all four of these machines the load-carrying capacity is determined by observing the load necessary to produce seizure when applied to two steel surfaces rubbing together at constant speed and lubricated with the lubricant under test. In each machine, however, at least one pertinent feature of design or test procedure differed widely from that of the others. Some of the major differences in design are: shape of the test specimens (three use a journal bearing; one uses a roll against a flat plate), size (diameters range from ¼ in. to 2 in., and widths from ½ in. to 1 in.), metal (differ in composition, heat treatment and method of preparing surfaces), and method of lubricating (three use bath lubrication with no temperature control; one uses gravity feed with pump return and electric heater). In the test procedures the chief differences are in the rubbing speeds—which vary from 6 ft. to 400 ft. per min.—and in the method of loading (three increase the load in definite steps until seizure occurs; one operates at various constant loads using a new specimen for each load).

The relative loads at seizure obtained with the nine lubricants on the four machines are given in Table 2. The values given are the ratios of the load at seizure for the given lubricant on the given machine to the load at seizure for lubricant No. 1 on the same machine. Lubricant No. 7 was not tested in machine No. 2.

Table 1—Types of Lubricants

Lubricant No.	Classification
1	Straight Mineral Oil S.A.E. 70
2	Mineral Oil plus Lard Oil
3	Commercial Lead-Soap Lubricant (Non-Corrosive)
4	Lead-Soap Lubricant Free from Sulphur
5	Commercial Sulphurized Lubricant
6	Sulphur-Chloride Lubricant (16⅔ per cent base plus 83⅓ per cent Lubricant No. 1)
7	Sulphur-Chloride Lubricant (72 per cent Lubricant No. 6 plus 28 per cent Lubricant No. 1)
8	Castor Oil, U.S.P.
9	Commercial Lead-Soap Lubricant (Corrosive)

From the data in Table 2 it will be seen that no two machines rate the lubricants exactly alike. There is a general agreement between machines Nos. 1 and 2 in the order of rating, but this order is different from the ratings on machines Nos. 3 and 4. All of the machines were in agreement in the rating of lubricant No. 6. With lubricant No. 3, however, machines Nos. 1 and 2 rate it high and Nos. 3 and 4 low.

The apparent lack of agreement shown by these machines where the conditions are widely different indicates the need for a comprehensive study of the variables affecting load-carrying capacity. To obtain some indication as to the magnitude of the effects upon the load-carrying capacity of the operating variables, speed and temperature, preliminary tests were run on some of the machines at different speeds and oil temperatures. The results of tests with the nine lubricants on one of the machines operating at speeds of 150 r.p.m. and 600 r.p.m. are shown in Fig. 1. In the tests at both speeds the same stepwise application of the load was used. The carrying capacities of lubricants Nos. 5, 6, 7, 8 and 9 at 150 r.p.m., and lubricants Nos. 6, 7 and 9 at 600 r.p.m., were

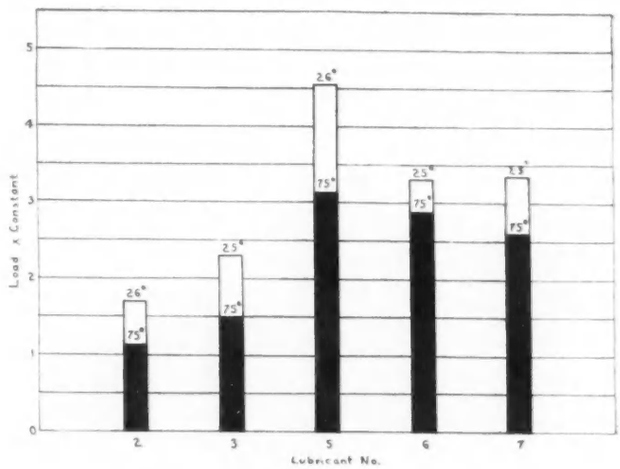

Fig. 2—Results of Tests with Five Lubricants on One of the Machines Operating at a Constant Speed and with a Constant Rate of Continuous Load Application But with the Temperature of the Oil Bath at 25 and 75 Deg. Cent., Respectively

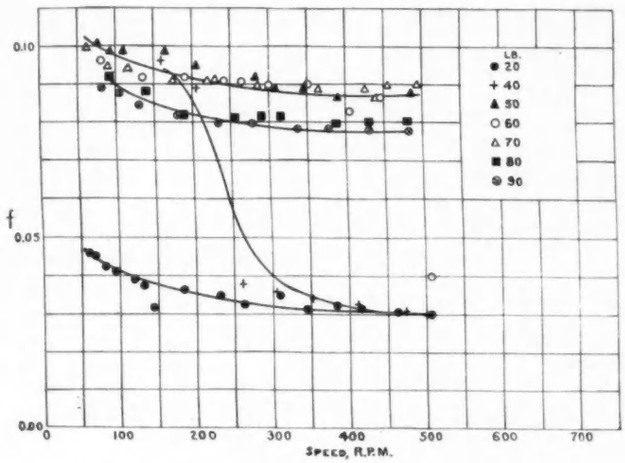

Fig. 3—Relation between the Coefficient of Friction and Speed Obtained at Various Loads on One Machine Using Lubricant No. 3

greater than the loading capacity of the machine. In so far as the capacity of the machine permitted, these tests indicate a marked increase in load-carrying capacity with decrease in speed.

The results of tests with five lubricants on one of the machines operating at a constant speed and with a constant rate of continuous load application but with the temperature of the oil bath at approximately 25 and 75 deg. cent. respectively are shown in Fig. 2. From these results an increase in load-carrying capacity with a decrease in temperature is indicated.

The curves in Figs. 3 and 4 show the relation between the coefficient of friction and speed obtained at various loads on one machine using lubricants Nos. 3 and 6. A different set of test specimens was used with each lubricant, each set being run in with lubricant No. 1 under the same operating conditions and for the same length of time before the runs were made on the extreme-pressure lubricants. It will be noted that with lubricant No. 6 an abnormally high curve was obtained only at the highest load. With lubricant No. 3, however, the friction became abnormally high at much lower loads, yet the maximum load before seizure was approximately the same for both lubricants. In these tests the temperature of operation depended upon the frictional power; thus, one possible explanation for the difference in the frictional characteristics shown by the two lubricants is that lubricant No. 3 required a higher temperature for its extreme-pressure characteristics to become effective.

Effect of Speed and Temperature.—The results of these preliminary tests indicated the desirability for a continuation of the study of the effects of changes in speed and temperature upon load-carrying capacity. Accordingly, two of the machines were modified to an extent sufficient to obtain data over fairly wide limits of speed and temperature. The choice of the two machines used was based upon two requirements; first, a wide difference as to the type of test specimen and, second, a minimum of change of design of the machine to provide for oil-temperature control.

Apparatus and Procedure.—For convenience, the machines selected are indicated as machine *A* and machine *B*, respectively. Machine *A* consists essentially of a flat steel block pressing against a steel roll rotating about a fixed horizontal axis, the block being mounted directly under the roll. The rolls and blocks used in these tests were very kindly provided by the manufacturer and are similar to those commonly used in tests with this machine, the roll being approximately 2 in. in diameter and ⅜ in. wide. The load between the roll and block is applied by adding weights to a lever arm acting on the block and provided with suitable knife edges for obtaining proper alignment between block and roll. The weight pan on the lever arm is provided with a suitable spring to minimize impact effects when the weights are applied. An auxiliary lever for measuring friction is provided on this machine, but friction measurements were not taken in these tests.

The lubricant under test is fed by gravity to the working surfaces from a container mounted above the roll spindle. A gear pump returns the lubricant from a catch basin under the block to the oil container. An electric heater mounted in the base of the container provides a means for heating the lubricant. For these tests the temperature control was improved by the addition of an electric heater, immersed in the lubricant, and by the installation of a by-pass and suitable valves in the discharge line from the pump. This by-pass consisted of a coil of copper tubing immersed in a large bath of water and provided a means for rapid cooling of the oil when necessary.

The temperature of the lubricant was measured with a

Table 2—Tests on Nine Lubricants

Lubricant No.	Relative Loads at Seizure Lubricant Testing-Machine No. 1	2	3	4
1	1	1	1	1
2	1	1	2	1.5
3	3	4	1	1
4	2	2.5	1	1
5	2	3	3	2
6	4	5	5+	3+
7	1	—	5+	3+
8	2	2.5	2	3
9	2.5	3	5+	2

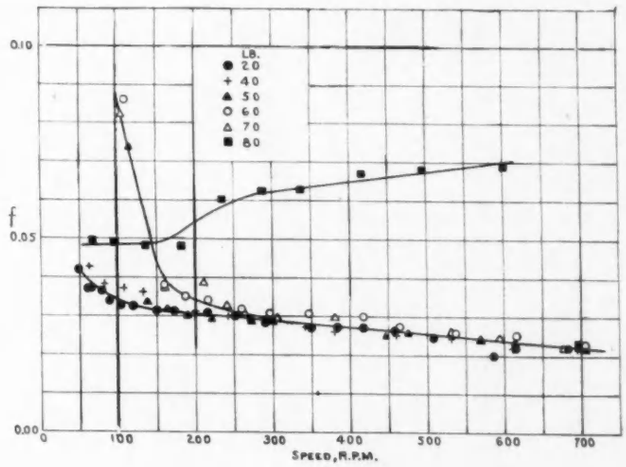

Fig. 4—Relation between the Coefficient of Friction and Speed Obtained at Various Loads on One Machine Using Lubricant No. 6

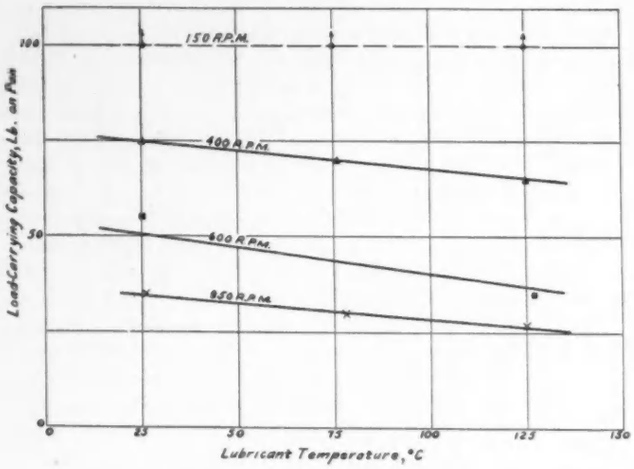

Fig. 5—Curves Showing the Relation between the Load-Carrying Capacity and Temperature for Various Speeds Obtained on Machine *A* Using Lubricant No. 3

thermometer placed in the oil container and that of the test specimens with a copper-constantan thermocouple attached to the holder for the block.

The machine was driven by an electric motor through a gearbox providing various speeds from 25 to 950 r.p.m. The driving mechanism was of ample size so that no reduction in speed was observed when scoring of the specimens occurred.

The load capacity of the machine is 100 lb. on the lever arm or 1000 lb. between roll and block, the mechanical advantage of the lever being 10.

In making a test run with this machine it was operated at a given speed with the lubricant circulating but without load until the desired temperature of the lubricant was reached. A given load was then applied to the lever arm and the machine allowed to run for 10 min. At the end of this 10-min. running-period the load was removed, the machine stopped and the block and roll examined for evidence of scuffing. This procedure was repeated, using a new roll and block face for each of several other loads until a sufficient number of runs had been made to enable a determination of the maximum load at which no scuffing occurred at the given temperature and speed. This load was recorded as the load-carrying capacity for the given lubricant at the given speed and temperature.

Machine *B* is of the journal-bearing type. It was modified to a considerable extent to obtain operating characteristics desirable for these tests. In this machine two steel half-bearings are pressed against a steel shaft, rotating about a horizontal axis, in a special holder that provides for bath lubrication and has a capacity of about 1 pt. of lubricant. The shaft diameter is ¼ in. and the bearing length ½ in.

The load is applied to the upper half-bearing by an hydraulic jack of the steel-diaphragm type clamped just above the oil bath, a shoe being fitted between the diaphragm and upper bearing. The reaction of this load is transmitted by the shaft to the lower bearing, which is supported from the bottom of the oil container by a shoe. This shoe is provided with a pin that fits into the lower bearing and prevents its rotation. A spring clip is also provided to hold both bearings in proper axial alignment. Hydraulic pressure was applied to the diaphragm head by placing suitable weights on a scale pan attached by levers to a vertical piston and cylinder which was connected to the jack by copper tubing. A heavy mineral oil was used as the transmitting fluid.

The holder containing the lubricant, shaft and bearings was mounted on a special pedestal, both holder and pedestal being insulated to reduce heat losses. Temperature control was provided by electric heaters, one in the pedestal and one of the immersion type in the oil bath. The temperature of the lubricant and the bearings was measured with a copper-constantan thermocouple inserted in the joint between the upper and lower half-bearings on the side where the friction caused by the rotation of the shaft tends to force them together.

Table 3—Experimental Data, Machine *A*

Speed, R.P.M.	Oil Temperature Deg. Cent.	Maximum Load before Seizure, Lb. on Pan	Speed, R.P.M.	Oil Temperature Deg. Cent.	Maximum Load before Seizure, Lb. on Pan
Lubricant No. 1			**Lubricant No. 3**		
24	25	100+	150	26	100+
25	75	100+	157	75	100+
25	125	100+	152	125	100+
152	22	60	398	25	75
154	75	55	404	76	70
153	125	50	397	125	65
408	28	25	605	25	55
399	75	25	626	73	40
400	124	20	620	127	35
619	26	15	940	26	35
626	75	11	940	78	30
617	129	8	947	125	27
Lubricant No. 5			**Lubricant No. 6**		
247	25	100	247	25	100+
253	75	95	262	75	100+
242	120	85	243	122	90
401	26	65	390	26	85
401	76	60	395	75	75
403	125	50	401	125	50
605	25	35	607	26	70
618	75	35	604	76	45
634	125	28	610	125	35
939	25	30	925	25	25
945	74	25	930	75	20
965	120	15	932	120	15

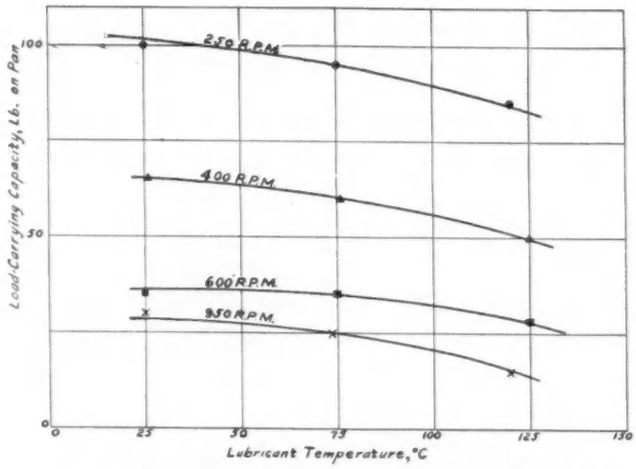

Fig. 6—Curves Showing the Relation between the Load-Carrying Capacity and Temperature for Various Speeds Obtained on Machine *A* Using Lubricant No. 5

Table 4—Experimental Data, Machine *B*

Speed, R.P.M.	Oil Temperature, Deg. Cent.	Maximum Load before Seizure, Lb. on Pan	Speed, R.P.M.	Oil Temperature, Deg. Cent.	Maximum Load before Seizure, Lb. on Pan
Lubricant No. 1			Lubricant No. 2		
100	26	6.0	100	26	5.9
100	53	6.0	100	51	3.2
100	72	2.0	100	74	1.7
100	99	2.0	100	100	1.3
100	123	0.6	100	125	0.8
500	25	3.0	500	25	2.5
500	51	2.5	500	50	1.3
500	76	0.7	500	76	1.0
500	98	0.7	500	99	0.9
500	127	0.4	500	127	0.6
900	25	2.0	900	27	2.0
900	51	1.7	900	51	1.0
900	71	0.6	900	78	0.9
900	96	0.8	900	102	0.6
900	124	0.8	900	126	0.5
1300	26	1.5	1300	29	1.4
1300	50	1.2	1300	51	0.8
1300	74	0.5	1300	76	0.9
1300	100	0.8	1300	100	0.7
1300	127	0.6	1300	123	0.7
Lubricant No. 3			Lubricant No. 4		
100	25	10.0	100	24	3.9
100	50	8.5	100	50	2.3
100	74	2.0	100	74	1.1
100	98	1.0	100	99	0.6
100	124	0.5	100	127	0.1
500	30	3.2	500	25	1.5
500	50	2.1	500	46	0.9
500	76	1.2	500	76	0.5
500	102	0.6	500	100	0.1
500	124	0.1	500	125	0.3
900	30	2.7	900	25	0.9
900	48	1.8	900	50	0.8
900	74	1.5	900	74	0.5
900	100	0.7	900	98	0.4
900	125	0.6	900	124	0.3
1300	31	2.0	1300	26	1.2
1300	50	1.4	1300	51	0.8
1300	75	1.3	1300	77	0.7
1300	99	0.5	1300	100	0.3
1300	124	0.3	1300	124	0.4

The machine was driven by an electric motor through a system of gearing that provides continuous speed-variation from 0 to 1300 r.p.m. The capacity of this driving mechanism was great enough so that no reduction in speed was observed when seizure of the test pieces occurred. The load capacity of the machine was 30 lb. on the scale pan or about 5500 lb. on the bearings.

In making a test run with this machine the lubricant, shaft and bearings were heated to the desired temperature by means of the heaters in the pedestal and oil bath. During this heating-up period the lubricant was stirred. When the proper temperature was reached the machine was operated at the desired speed with no load for ½ min. after which a given load was applied and maintained constant for a period of 1 min. The load was then released, the machine was stopped and the shaft and bearings were examined for indications of seizure or scuffing. As in the tests with machine *A*, test runs with this machine were repeated using new specimens for each of several loads until a determination of the maximum load carried without seizure for the given speed and temperature was obtained.

Discussion of Results.—The results of the tests with machine *A* on four lubricants at speeds from 25 to 950 r.p.m. and temperatures from 25 to 125 deg. cent. are given in Table 3. The values obtained with machine *B* on eight lubricants at speeds from 100 to 1300 r.p.m. and temperatures from 25 to 125 deg. cent. are given in Table 4.

The results given in these tables indicate that, within the limits covered by these tests, the load-carrying capacity of an extreme-pressure lubricant depends to a considerable extent upon the temperature of the lubricant and upon the rubbing

Table 4—Experimental Data, Machine *B*

(Continued)

Speed, R.P.M.	Oil Temperature, Deg. Cent.	Maximum Load before Seizure, Lb. on Pan	Speed, R.P.M.	Oil Temperature, Deg. Cent.	Maximum Load before Seizure, Lb. on Pan
Lubricant No. 5			Lubricant No. 6		
100	27	13.0	100	29	30.0
100	49	10.0	100	50	30.0
100	74	7.0	100	78	28.0
100	101	5.1	100	96	16.0
100	123	2.6	100	130	13.0
500	26	5.0	500	46	14.0
500	49	4.7	500	53	12.0
500	74	3.6	500	76	9.0
500	100	3.1	500	99	6.5
500	127	1.9	500	130	5.0
900	29	3.0	900	31	9.0
900	54	3.0	900	53	5.0
900	74	2.2	900	78	4.0
900	98	1.5	900	98	3.0
900	125	0.9	900	125	3.0
1300	27	2.2	1300	30	4.0
1300	51	1.3	1300	55	4.0
1300	75	1.1	1300	76	3.0
1300	98	1.0	1300	99	4.0
1300	124	1.1	1300	127	4.0
Lubricant No. 8			Lubricant No. 9		
100	27	6.1	100	29	10.5
100	48	3.5	100	48	9.0
100	71	2.5	100	75	6.8
100	100	2.0	100	99	5.8
100	125	1.7	100	123	4.5
500	30	2.5	500	31	3.5
500	50	1.9	500	53	2.8
500	75	1.1	500	75	2.8
500	94	1.0	500	97	2.7
500	125	0.8	500	123	2.7
900	26	2.0	900	33	2.6
900	53	1.4	900	48	2.2
900	74	0.5	900	78	1.9
900	100	0.4	900	100	1.6
900	125	0.4	900	126	1.6
1300	31	1.6	1300	24	1.7
1300	50	1.0	1300	50	1.4
1300	71	0.6	1300	80	1.3
1300	100	0.6	1300	99	1.0
1300	127	0.5	1300	127	1.0

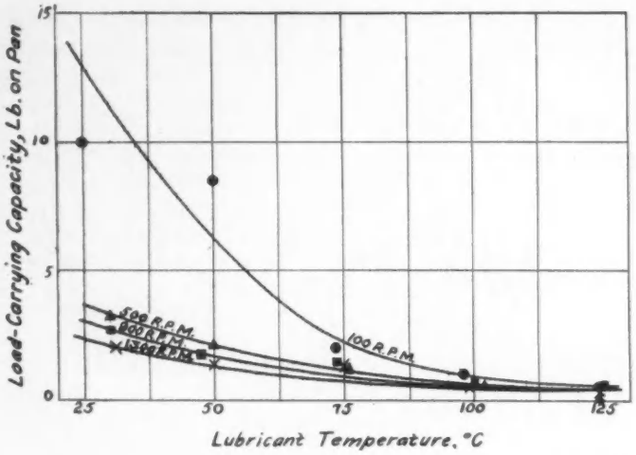

Fig. 7—Curves Showing the Relation between the Load-Carrying Capacity and Temperature for Various Speeds Obtained on Machine *B* Using Lubricant No. 3

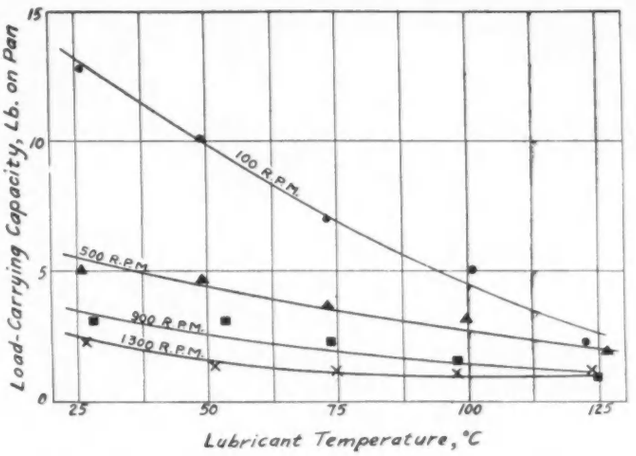

Fig. 8—Curves Showing the Relation between the Load-Carrying Capacity and Temperature for Various Speeds Obtained on Machine *B* Using Lubricant No. 5

speed. In general, the load-carrying capacity tends to decrease with an increase in temperature or with an increase in rubbing speed. This is illustrated in Figs. 5, 6, 7 and 8. In Figs. 5 and 6, the curves showing the relation between the load-carrying capacity and temperature for various speeds obtained on machine *A* using lubricants Nos. 3 and 5 respectively are shown, while similar curves obtained on machine *B* using the same lubricants are given in Figs. 7 and 8.

These data indicate also that the effect of a given change in speed or temperature is not of the same magnitude with each lubricant. This is illustrated in Figs. 9 and 10, where the relative loads at seizure obtained at the indicated speeds and temperatures with machines *A* and *B*, respectively, are shown. The relative loads at seizure are the ratios of the load at seizure for the given lubricant at the given temperature and speed to the load at seizure for lubricant No. 1 at the same temperature and speed. The values given for 950 r.p.m. and 125 deg. cent. in Fig. 9 are based upon an extrapolated value of 4 lb. for oil No. 1, since this lubricant was not run under these conditions.

The results shown in these figures are of particular significance in that they indicate that the relative load-carrying capacities for the various lubricants at a given speed and temperature are not proportional to those obtained at other speeds and temperatures. In fact, the performance of some of the lubricants varied with changes in speed and temperature to such an extent that the order of rating for the lubricants at low speeds and temperatures is different from the order obtained at high speeds and temperatures.

To obtain a direct comparison of the performance of the two machines at the same rubbing speed, the revolutions per minute of the roll in machine *A* would have to be about one-eighth that of the shaft in machine *B* since the roller is approximately eight times the diameter of the shaft. An attempt was made to obtain this direct comparison by operating machine *A* at a speed of about 150 r.p.m., which is approximately one-eighth of the maximum speed obtainable with the driving mechanism on machine *B*. It was found, however, that, with the lubricants used, the load-carrying capacities of all except No. 1 were beyond the capacity of the machine. But in this connection it is of interest to note the difference in the performance of lubricant No. 3 in the two machines as indicated in Figs. 9 and 10. From Fig. 9 it will be seen that with machine *A*, the relative load-carrying capacity of oil No. 3 tends to increase with an increase in rubbing speed and temperature. With machine *B* as in Fig. 10, however, the relative capacity of this lubricant drops off to a marked extent at the highest rubbing speed and temperature. This difference is of significance in that it is an indication that the shapes of the rubbing surfaces, and the composition and hardness of the metal, may play an important part in the effectiveness of an extreme-pressure lubricant.

It is planned to continue the tests with lubricant No. 3 on machine *B*, using test specimens of the same material and with the same heat treatment to determine whether the apparent difference in the performance of this lubricant on the two machines is caused by the shape of the test specimen, the kind of metal or a combination of both.

Because of the considerable number of test specimens and the time involved, check runs were not made for all the data obtained in the foregoing tests. A few check runs on machine *B* indicate that the particular value of the load-carrying capacity of a lubricant obtained under given conditions of operation on this machine is different for different test specimens. In these tests, however, possible differences due to variations in the specimens are reduced to some extent by the fact that runs with at least three and usually four or five test specimens were necessary to obtain a single value for the load-carrying capacity. Thus, while the particular values obtained are affected by the condition of the test specimens used, it is believed that the data do indicate in general the trend of the effect of changes in speed and temperature upon the performance of a given lubricant.

On each of the four of the machines used in the preliminary tests the shape of the test specimens is such that wear on the specimen tends to increase the area of contact. It was noted that rapid wear usually occurred under the conditions of operation necessary to approach the point of seizure; thus the pressure was continually changing, even though the load was held constant and no accurate determination was possible of the actual pressures which the lubricants would carry. This presents a serious difficulty in attempting to rate the lubricants in the order of their load-carrying capacity, since the wear characteristics of the specimens may vary with

different lubricants. Thus, while the data here presented indicate the effects of some of the factors involved in the determination of the load-carrying capacity of extreme-pressure lubricants, it would not be justifiable to assume that these data are an accurate indication of the respective capacities of the various lubricants.

Conclusions.—From the results of these tests the following conclusions are indicated:

(1) The four lubricant-testing machines, when operated as recommended by the manufacturers, do not rate the lubricants in the same order. Further, no set of operating conditions has been found for each machine such that all the machines will rate all the lubricants in the same order.

(2) The load-carrying capacity of an extreme-pressure lubricant tends to decrease as the temperature increases.

(3) The load-carrying capacity of an extreme-pressure lubricant tends to decrease as the rubbing speed increases.

(4) The effects of speed and temperature differ with the particular lubricant and machine involved to such an extent that even the order of rating may be changed.

(5) The ratio of the applied load to the actual pressure changes rapidly on running with each of the four machines, which throws serious doubt on the comparability of the data.

For any satisfactory apparatus, it is desirable to have the ratio of the applied load to the actual pressure remain constant throughout each run. To this end a machine is being developed at the Bureau of Standards in which this ratio will remain essentially constant during each run. An additional feature of interest in this machine is that, not only may the speed and temperature be changed over wide limits, but also the action between the surfaces under load may be changed as desired from pure sliding to pure rolling with various intermediate steps of combined rolling and sliding.

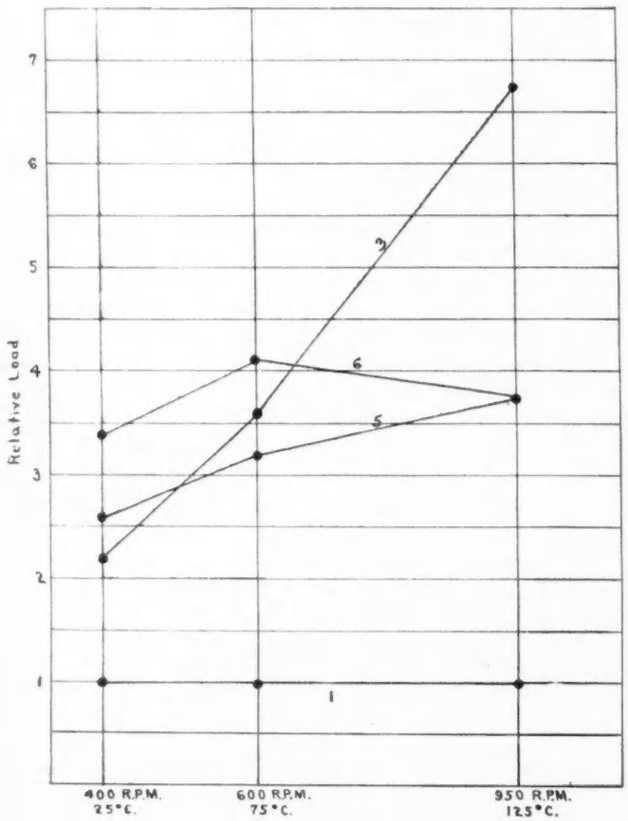

Fig. 9—Relative Loads at Seizure Obtained at the Indicated Speeds and Temperatures with Machine *A*

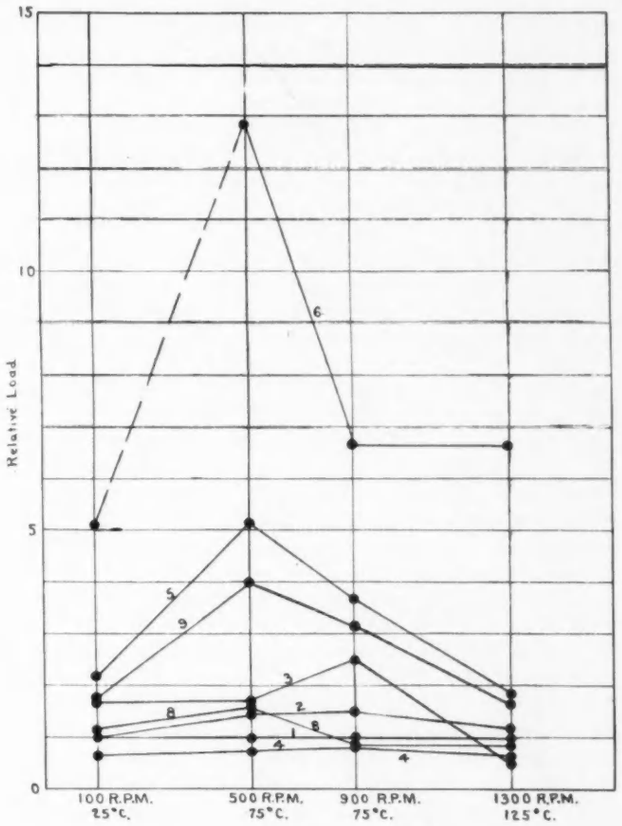

Fig. 10—Relative Loads at Seizure Obtained at the Indicated Speeds and Temperatures with Machine *B*

A. S. A. Issues Year Book

THE establishment during the past 12 months of 31 new national industrial standards affecting the construction, electrical, mining, oil, steel, radio, and almost every other major American industry is recorded in the American Standards Year Book recently issued by the American Standards Association. The year book records the cooperative achievement of 3000 scientists and engineers representing more than 500 national technical and trade organizations in the development of a unified system of basic technical standards for industry. This work which was started in 1918 has gone on without abatement during the past few years despite the depression.

Daniel C. Roper, United States Secretary of Commerce, in a foreword to the year book points out the importance of industrial standards in commerce. "National recognition of such standards," Mr. Roper says, "will remove misunderstandings and expedite commercial transactions. Especially is this important in interstate and international trade when the buyer is unable to inspect personally and select the commodities offered by the seller."

Successful Valve-Design Considerations

By H. L. Horning

President and General Manager, Waukesha Motor Co.

IN LAYING out an L-head or overhead-valve engine, the length of the engine is determined largely by the size of the valves and the spaces that must be allowed between the valves in order to give high volumetric efficiency through the intake valves and protect the exhaust valves from destructive heat.

We work on the basis that 230 cu. ft. per sec. through the intake valve, when wide open, gives the maximum torque. Because most of the modern engines have the valves lying on one line running longitudinally, the demand for increased speeds has led to an enlargement of the intake valves and a decrease in the size of the exhaust valves.

Engines of 25 years ago had such a small output per cubic inch (30 hp. for a 250-cu.-in. engine) and ran at such low speeds that valves could be made of the same size and material and therefore interchangeable. The rule established then survived by custom until it became necessary to meet higher speed and load conditions.

Heat Absorption and Dissipation

In European and American high-speed engines it has been found that the area of surface of the exhaust valve exposed to the radiation from the flame in the cylinder and from the exhaust flame passing by the valve determines the amount of heat which the valve absorbs, and therefore the amount of heat to be dissipated from the valve and consequently the temperature the valve reaches.

The only known ways to cool an exhaust valve are through the valve seat and the valve stem. As the speed and the maximum horsepower at which an engine can run continuously are determined by the condition of the seat and the stem of the exhaust valve and the ability of these surfaces to radiate the heat, we arrived at the simple fact that the speed at which an engine can run depends upon the area of the surface exposed to the radiation of the flame and the efficiency with which the exhaust-valve stem and seat can maintain their contact with the cylinder block.

The success of all companies making engines depends upon these factors, and the next few years will find this much more important than in the past. The effect of all these considerations on the size of the valves is that it is now desirable to design engines with the clear diameter of the exhaust as low as 75 per cent of the size of the intake valve.

The material used in the valve-seat of the cylinder has been found to determine largely what will happen to the valve seat. Of all the gray-iron mixtures tried, molybdenum iron best resists breaking down of the seat. The valve seat of the cylinder is the cause of pitting, erosion and picking up in various forms. To keep the valve and its seat at practical temperatures, attention must be given to the circulation of water around the exhaust valve, as it is more important to see that this portion of the cylinder is properly cooled than any other part. As the power output of engines has increased, it has been found desirable to increase the size of the exhaust-valve stem. The material taken out of the head by reduction of the diameter can be placed on the stem to good advantage, thus increasing the surface of the stem and its radiating ability. Also it has been found good practice to protect the stem from the flame by bringing the valve guide high on the stem as an apron but not in contact with it, so that the guide acts as a shield to protect the valve stem.

One of the difficulties encountered in the opening and closing of valves at high speeds is the accuracy with which the valve comes to its seat. No matter how carefully the cam contour is designed so as to lay the valve softly on its seat, a considerable blow is delivered when opening and closing the valve at the rate of 30 times per sec., and, if the clearance between the stem and the guide is large, this blow may come on just one point of the valve and the seat and considerable confusion may occur before the valve is fully seated. Theoretically and practically, the way the valve should move is accurately along the center line of the valve stem. It is very necessary to keep the guide well cooled, the guide bore very accurate, and the valve stem straight, so that the minimum clearance can be allowed between the stem and the guide. All of these points seem axiomatic but are actually very difficult to realize.

Valve Stem Lubrication

The importance of lubrication of the valve stem has been underestimated as a factor in keeping the valve cool. The difference in temperature of the valve when the stem is poorly lubricated and when well lubricated may be as high as 250 deg. fahr. With the high temperatures attained by the exhaust-valve head, it has been found that the thickness at the valve seat should be considerably greater than that of the intake-valve seat. Slots for grinding cannot be used in exhaust valves in high-speed engines because of distortion; much better practice would be to leave the exhaust-valve head plain, smooth and polished, if possible.

Since the amount of heat to be dissipated depends upon the valve area exposed to the flame, and the heat-dissipating ability of the valve depends upon the area of the valve-seat face and the area of the valve stem in contact with water-cooled guide, these elements must vary with the valve ex-

[From an Annual Meeting paper entitled Theory and Practice.]

posure. A 30-deg. seat has been found to give the highest charging ability to an intake valve and can be used for the exhaust valve. The flat-seated valve has the advantage of expanding easily in the plane of contact, and therefore has certain advantages in maintaining tightness; however, the charging ability of the flat seat is much lower than that of the 30-deg. seat.

The very serious and menacing problem involved in maintaining valves against erosion by high-temperature flames has brought the science of metallurgy to the highest development in connection with valve material and cylinder-seat material. High-chromium valves seem to give the best performance. Stellite and high-speed tool steels for the cylinder seats are among the best materials that give excellent results. The molybdenum-chromium-nickel gray-iron mixtures are the best for valve inserts.

Facts Learned about Valve Springs

Another necessity is to have valve springs that contract accurately along their longitudinal center line and maintain valve-spring seats square with that line at all contractions. This would assure quiet operation of the valves and prolong the time between valve-seat grindings. This again is axiomatic but difficult to attain.

These are some of the details to keep in mind in laying out the valve line, which determines the length of service of the engine itself and the length of time it will run at high speed without valve grinding and without serious maintenance expense.

In the valve spring itself we have a whole realm of technique that can be understood, studied and controlled only by entirely new methods. One of the interesting facts determined in the last few years is that the best material for valve springs is a carbon steel of a certain specification. Most of the formulas for making springs have been based on old investigations and assume a uniform stress across the cross-section of the wire. This assumption is by no means correct; it is easily proved that the highest stress is developed on the inside of the coil, or that part toward the center of the spring. Spring wire is supposed to be easy to make and the steel specifications easy to fulfill, but neither of these assumptions is correct. The specifications must be kept very carefully between certain definite limits, the heat-treatment must be very carefully handled, and the drawing dies must be free from nicks or particles that will cause creases in the wire. In practice, a break invariably starts on the inside of the coil at a crease or a nick. No matter how well the spring is heat-treated or how carefully it is designed, it will fail in high speed because of such a defect in manufacturing. The decarbonizing of the surface of the wire during heat-treatment places the highest stresses at the inside of the coil in the lower-carbon steel, which is a further cause of fracture.

High-speed engines have brought out clearly the importance of periodicity. The natural period of the valve spring must be considerably above any speeds that the engine itself will take. Nothing but service under exceedingly high speeds could develop the fact that valve-spring breakage often results from the coils clashing on one another and thus producing much higher stress within the coils than is normal, and sometimes waves moving up and down in the coil, and other synchronous effects such as one wave coming up sometimes meeting another going down, cause breakage.

We all think of valves moving up and down in an orderly manner, following the contour of the cam and returning to their seats very quietly. This is seldom the case, because the spring does not contract squarely or its end coils do not seat squarely, or, owing to the torsional deflection of the spring, there is an overrun that tends to rotate the valve at the moment of seating. It is found also that the valve may actually bound off the seat at the moment of seating, thus causing a grinding action. The vibration of the spring is, therefore, a cause of excessive valve-seat wear.

The stroboscope shows us that the valve rotates slightly no matter how accurately the push rods, cam-shaft, valve springs, guides and valve seats are made. Nothing is so necessary to the success of operation in modern high-speed engines, and to long life of the engine between overhauls, as correct valve-spring design.

I have mentioned the more important considerations, but there are 13 or 14 more specifications that are necessary for the manufacture of valves and their springs to assure the success of valve operation.

Research Develops Needed Products

WHAT distinctive features, if any, mark the present market for engineering talent?

One of the first needs indicated in this picture is for research that will discover new products or new uses for old products. The injection into the sick industrial system of some new product of particular appeal has in the past proved a powerful stimulant toward recovery.

Industry needs research in its present sickness; it also has in itself the elements for the cure. Organization of business into large units amasses reserves of capital to pay the bills of research. Continuity of existence of large corporations enables them to play a waiting game while new ideas are being born and perfected in their laboratories. Of course, big business is not the sole or indispensable support of research, but it is a powerful ally.

Leading manufacturers estimate the ratio of profit to amount spent for research at from 100 to 300 per cent. Research activities find their way into the annual reports of large companies, along with finance, markets, operations, labor conditions, general business conditions and outlook. Research does not seem to be depressed. In the most recent of surveys made by the National Research Council, 309 laboratories, representing 19 industries, reported on their research expenditures. Of these 51.3 per cent had increased their expenditures during 1931 as compared with 1929; 18.7 per cent had made no change.

In bringing a new product into the market fundamental research is followed by experimental design and development; then comes production, marketing and distribution, in all of which the engineer plays an important part. Much has been written and much remains to be written about the technically trained man's inter-relation to all these functions and certainly those industrial concerns of the future will be most successful which best utilize the engineer in these interdependent activities. However, if industry is to flourish its products must be utilized and it is in this utilization that the engineer may expect to find the greatest increase in demand for his services.

Excerpts from paper presented to Cleveland Section, May, 1933, by C. B. Veal, Research Manager, S.A.E.

Prominent Members Pay Tribute to Life and Work of A. F. Masury

AS one day follows another the Mack organization becomes more impressed with the great loss we have suffered individually and collectively through the untimely death of Alfred Masury.

Seldom in the engineering profession do we encounter an individual with traits and abilities as distinctive in character as this man possessed and demonstrated to us on every occasion.

His interests were wide and to each he gave careful thought and study.

The results will be felt, we believe, for many years to come.

All in our organization feel keenly the loss of a close personal friend, and we are grateful for this opportunity of expressing our appreciation of all that he has done for us and our industry.

—A. J. Brosseau

WHEN organizing the Hewitt Motor Co. in 1907 I sorely needed a young graduate engineer. A friend of mine recommended a young man who was then working with the Vaughn Machine Co. at Peabody, Mass., and he came down to see me. The red-headed young man took my fancy and became a member of the staff. This was Alfred F. Masury who had graduated from Brown University only a few years before and had been employed with General Electric Co. and Vaughn Machine Co.

From that time until the time of his death we were closely associated in business. At the absorption of the Hewitt Motor Co. by the Mack International Motor Truck Co. I became chief engineer for a while and when I found I could not give the work the full attention required, Mr. Masury was appointed chief engineer and he served in that capacity until the time of his death.

There is no question that much of the success of the engineering problems of the Mack Company has been due to Mr. Masury's work. He was universally liked by all his associates and was extremely popular with the whole automobile trade and all our customers.

My own personal relations with Mr. Masury were the very closest and we were most excellent friends for at least 26 years. While we often disagreed on engineering problems we never had the slightest personal friction in all that time—and this is a rare thing to say of a man with whom one has been associated over such a long period.

The Mack Company will feel his loss very keenly and I feel sure that the entire automobile industry will be the poorer for his passing away. His genial smile and pleasant personality were always an encouragement in all kinds of difficulty and he never lost courage, no matter what happened; this was one of his great qualities. I am too far advanced in years now to make other friends as close as he was and I will sincerely miss him during my remaining years.

—Edward R. Hewitt

WITH the passing of A. F. Masury, the engineering world and the Society of Automotive Engineers particularly, lost a staunch, true friend whose outstanding qualifications and accomplishments left an imprint upon them.

Early in life his ambition and well-balanced qualities established him as an outstanding character in the business world, while his ever tolerant, generous and sympathetic nature endeared him to his more intimate associates.

For years he contributed to the S.A.E. liberally of his time and talents—to its management and fundamental purpose—the dissemination of engineering information for the benefit of mankind.

We who knew him best, acknowledge our debt of gratitude and mourn his passing, but in our grief we find solace in the fact that he passed from us in a way that enshrined him in the hearts of his countrymen and emblazoned his name and accomplishments for future generations to venerate.

—J. F. Winchester

THERE is a void in my life—Mike Masury has passed away.

I believe those of us who were privileged to know "Red Mike" well, who sat and smoked with him on his little yacht, who fought and argued about mechanical and philosophical things in general, learned to love him as a two-fisted "he-man."

I think I have been one of the few that have been privileged to be with Mike on the water, in the air and on the land, and if there ever was a human being who

Alfred Fellows Masury
1882 - 1933

had his feet on the ground, who thought keenly, clearly and concisely, it was this Col. A. F. Masury.

I do not think I want to go near Port Washington where he kept his little boat for a long time.

We of the Society can ill afford to lose a man of this type. May his passing inspire us to follow in his footsteps.

—F. E. Moskovics

I WAS inexpressibly shocked to learn of Alfred Masury's death. He was one of my closest friends. I admired his personality immensely. He was a man in every sense of the word; loyal to his friends and associates, dependable, warm-hearted and lovable. I still cannot believe that we shall never see him again.

In the passing of Alfred Masury the automotive industry has lost an outstanding figure. He helped to make its history and he leaves behind him an enviable record of engineering achievement. It will be difficult if not impossible, to replace him and his place in the memory of his many friends can never be filled.

One can only speculate upon the final resting place of Alfred Masury's adventurous spirit. The angels, if there are any, should certainly extend to him a hearty welcome, but in any event his associates whoever they may be are likely to experience some interesting moments.

—G. A. Green

I HAVE known Alfred Masury since the time that he worked on the Hewitt trucks in the little shop in 31st Street, New York, and I have had unusual opportunity to watch his career since that time.

It seems to me that he had grown more and more to exemplify the qualities that a real engineer should possess. He was certainly a good executive and a friendly cooperator, both abilities supremely important in modern business.

Professionally, his work was always marked with common sense and courage. He made no claim to being a scientist, but knew well how to use the results of scientific research.

In matters of general design he tried very successfully to fit the vehicle to the job. In detail design he tried to fit the vehicle to the particular buyer's work and to follow it into service with his personal interest. He thus added selling in its most useful form to his other accomplishments.

His courage in design was very marked. He did not fear to lead if an advance seemed to be possible, but equally he had the courage not to follow a new trend until he had satisfied himself that it represented a permanent improvement.

His native ability, coupled with his early training in a very small organization that gave him a complete picture of business operation, made him an outstanding figure in the automotive industry.

—Henry M. Crane

ALFFRED MASURY was a great engineer. His vision extended far beyond the technical bounds of engineering. He took a keen interest in automotive transportation and was a student of all scientific and technical projects and was always most willing to lend his whole-hearted support.

His acquaintances covered not only his business sphere but extended to a host of friends for whom no sacrifice or effort was ever too great.

To know him was to like and admire him. I considered him one of the best friends I ever had and I know I shall never forget him.

—V. W. Kliesrath

TO very few men is it given to make the firm and lasting friendships that our old friend Masury enjoyed. It was my privilege to have known him for about thirty years, which takes one back into those days of the automobile industry where a friend was a real asset.

During the intervening years, our paths often crossed and I had ample opportunity to see him in action. Often our paths have been common and we have worked together, notably in connection with Ordnance matters.

Needless to say, our views did not always agree and sometimes the varnish on the table top suffered. But the spirit he always exhibited at such times was eminently fair. It is a pleasure to disagree now and then with a square shooter—and Mike was just that.

The industry will miss him. His friends will always feel that something they possessed and enjoyed is gone from them forever. There is no greater tribute a man can receive.

—H. W. Alden

I WILL miss Al Masury. He was truly a friend and after all, there are too few of them to be found in the course of an ordinary life.

As a competitor he fought clean and hard. After the toils of the day were behind him he sought his rest on the water he loved so well. Possibly from his sturdy New England parentage he acquired this love of the sea. It was an enjoyable privilege to those of us who were able to spend some of these restful hours with him.

He was youthful in his outlook, with an insatiable curiosity about new ideas and developments. He gave his life in the pursuit of a line of thought that one would hardly associate with the designer of the sturdy Mack truck.

Only time will tell the lasting monument he has erected to his own memory in a life work well done in the interests of transportation.

—A. W. Herrington

IT is with deepest feelings of affection and respect that I always appreciated my friendship with Alfred F. Masury whose constancy and loyalty to his many friends was unquestioned and unqualified.

I also judged him as a great engineer combining not only a scientific technical knowledge of internal combustion engineering and automotive design but he also had a rare faculty for successfully applying the purely theoretical to the practical requirements of every day industrial uses. His death is a great loss to the automotive industry.

—Vincent Bendix

THE dramatic end of the United States Government airship Akron and the loss of almost the entire personnel, took with it the life of Col. Alfred F. Masury. This catastrophe shocked the entire world and when it was definitely established that Al Masury had perished, I suffered a distinct feeling of personal loss. His valuable counsel was always available for any of his friends seeking it. He gladly gave of his great fund of knowledge, ever willing to give his time to help others.

His generosity extended to material things. It pleased him to share his luxuries with those of his less fortunate fellow men.

Sports were his hobby, yachting his passion, and work his staff of life. The automotive industry has lost a brilliant mind, an untiring worker and a personality that asserted itself where learned men convened to discuss things automotive. His many contributions to the engineering world and more particularly to the automotive field will remain monuments to his memory, if a man of his high attainments and accomplishments needs a memorial.

It was his pioneering mind that indirectly lead him to his untimely end—like others who have gone before him, unafraid to explore into new fields, gaining facts by being on the line of battle.

On May 17, 1929, when he was aboard the Graf Zeppelin a guest of Dr. Eckener, with four of the five motors aboard useless, the great ship drifting directly into the Pyrenees, death was cheated by a favorable wind that enabled Dr. Eckener to navigate the ship back to French soil. Undaunted by this narrow escape he sought eagerly for this position on the night the Akron took its last ride. His end came while he was at the top, but he died as he lived, a martyr to his life's work—"an engineer first and always."

—A. F. Coleman

I WAS connected in a business way with Alfred Fellows Masury for six years and during a large part of that period we spent most of our spare time together on the water or in testing trucks or other vehicles. As a matter of fact, it was his interest, leadership and fine example that gave me my start in the automotive field. Mr. Masury's principle of only producing the best which was possible to design and engineer has always been remembered and admired by me.

There is no doubt the fine engineering work done by A. F. Masury and his late co-worker, A. H. Leipert, are largely responsible for the success of Mack trucks.

Although the following maxims were not so expressed or written, they were the guiding spirit of A. F. Masury's engineering organization:

Always design the simplest and best way you know how, and use the best materials available.

Know what is being done in this country and in Europe in the same field.

Never adopt a design, only an idea or basic principle; but develop your own design, based on engineering reason and calculation.

Give an engineer the responsibility for a development and have him follow it through conception, design, testing, perfecting and its production.

Besides a deep feeling of personal loss for a staunch friend, constructive thinker and adviser, there is a great loss to the industry of such an outstanding character.

—A. Griswold Herreshoff

I HAVE been closely associated with Colonel Masury for the past three years, during which time he was Chairman of the Ordnance Advisory Committee of the Society of Automotive Engineers. From my association with him I formed for him the highest regard, both as an engineer and as a man.

His approach to all technical problems was with the sole idea of assisting his country in developing equipment second to none, and he gave unrelentingly of his time and energy in securing this end. His viewpoint was ever broad and constructive.

In the Ordnance Department, we not only admired him as an engineer of great ability but regarded him in every sense as a comrade. He ingratiated himself by his kindliness, sense of humor and good taste in all matters, both professional and personal.

He will be sorely missed from our councils, but the impression he made will long survive.

—C. M. Wesson

OPPORTUNITY KNOCKS TWICE

VARIED PROGRAM FOR ANNUAL MEETING IN DETROIT

Annual Dinner Now Set for Jan. 11

THE PAGE marking Wednesday, Jan. 11, will soon be torn from the calendar and the day itself will go to join the great company of the yesterdays. On the succeeding day, many luncheon tables, Pullman car conferences and other gatherings of men prominent in the automotive and allied industries will witness enthusiastic, reminiscent conversations, of which the following may be regarded as typical.

"Bancroft Gherardi made a deep impression on that crowd at the Hotel Pennsylvania last night."

"And Faulkner, too! What a speech!"

"Werrenrath certainly went over big!"

"He always does. Have you been to that new show in which he is starring, *Music in the Air*?"

A pause; a chuckle; another chuckle; and then—

"Rube Goldberg! He's the darndest guy. How *does* he do it?"

"I'll tell you that, if you'll tell me how Ket does what he does."

"That stumps me; all I can do is to say, quite briefly, that Ket is not *a* toastmaster; he is *the* toastmaster."

A Few Facts

But coming back to the reality of the present, away from the fancied peep into the future, the Annual Dinner Committee announces that the speakers at the Annual Dinner will be Bancroft Gherardi, engineering vice-president of the American Telephone & Telegraph Co., and Roy Faulkner, president of the Pierce-Arrow Sales Corp. Reinald Werrenrath, well-known baritone and star of the current Broadway hit, *Music in the Air*, has consented to sing, to the great delight of all who plan to attend the dinner. Rube Goldberg, the "inventor," is sure to excite the risibilities of the audience when he tells about his new automotive contraption, describing many features which his hearers will unquestionably not wish to include in their new models. The toastmaster will be Charles F. Kettering, vice-president of General Motors Corp.

Reservation blanks were sent to all members the middle of December. Members planning to attend the Dinner who have not yet sent the blank and remittance to headquarters are urged to do so at once if they wish to be sure of securing a desirable place at the Dinner. The following prices will prevail: Members, $4; ladies, $4; non-member guests, $5. Special tables will be reserved for ladies. Applications will be filled in the order in which they are received, and no refunds will be made or cancellations accepted after Jan. 9.

Arrangements for the Annual Dinner are under the capable direction of the following committee: Adolf Gelpke, chairman; A. L. Beall and Walter C. Keys. It was through the very effective cooperation of F. E. Moskovics that Messrs. Gherardi, Werrenrath and Goldberg were prevailed upon to participate in the program of the Annual Dinner. Norman G. Shidle, chairman of our Meetings Committee, acted on behalf of the Annual Dinner Committee in soliciting Mr. Faulkner's assistance.

A Good Time's Coming! Help It On!

Nearly 300 years before the first automobile made its appearance, a scientific, philosophic writer announced that "Knowledge is power"; and English-speaking people have been quoting that short but eloquent sentence ever since. Granting that knowledge is power and that, consequentiy, an increase in knowledge is likely to result in additional power, the forward-looking engineer is eager to augment his store of knowledge, especially at the present time when the recognition of man's need for bettering his lot finds constant expression in the current phrase, "More power to you!"

An opportunity to gain a great deal of knowledge in return for a relatively small expenditure of time and money will be afforded S.A.E. members who attend the Annual Meeting in Detroit, this month. The Annual Meeting, in accordance with a custom of several years' standing, will be held at the Book-Cadillac Hotel. The program is printed on p. 13.

To Be Specific—

T. R. Dahl, of The White Co., in speaking about legislation affecting motor-vehicle transportation, will present facts of such significance that every progressive fleet operator will be eager to hear him.

Col. E. J. W. Ragsdale, of the Edward G. Budd Mfg. Co., will cover the developments incident to placing rail-cars on pneumatic tires and the story of the operation of these vehicles in experimental and scheduled service, including a brief anlysis of the economics of light-weight structures.

The visit to the aeronautical laboratory of the University of Detroit, arranged by George L. McCain on behalf of the Passenger-Car Committee, through the splendid cooperation of Prof. P. Altman, of the University of Detroit, will offer a rare opportunity to S.A.E. members to see the interesting work that is carried on in the laboratory. This visit, preced-

MEETINGS CALENDAR

BALTIMORE—JAN. 19
Hotel Emerson; Dinner 6:30 P.M.
AIRCRAFT MEETING

BUFFALO—NO MEETING

CANADIAN—JAN. 19
Royal York Hotel, Toronto, Ont.; Dinner 7:00 P.M.
The Daimler Fluid Flywheel and Preselective Gear Set—E. A. Cosford, Pres., Associated Equipment Co. of Canada, Ltd.

CHICAGO—JAN. 31
Congress Hotel, Ballroom; Dinner 6:30 P.M.
AUTOMOBILE SHOW BANQUET
F. K. Glynn, Toastmaster
Speakers: To be announced later

CLEVELAND—NO MEETING

DAYTON—NO MEETING

DETROIT—JAN. 23 TO 26
Book-Cadillac Hotel
Cooperation in Annual Meeting of the Society

INDIANA—NO MEETING

METROPOLITAN—JAN. 9 AND 26
Jan. 9—Hotel New Yorker, New York City; Dinner 6:30 P.M.
AUTOMOBILE SHOW MEETING
The Business Outlook and the Automobile Industry—Dr. Virgil Jordan, Editor *The Business Week*
Jan. 26—Hotel New York, New York City; Dinner 6:30 P.M.
AIR TRANSPORTATION MEETING

MILWAUKEE—NO MEETING

NEW ENGLAND—JAN. 11
Walker Memorial, Massachusetts Institute of Technology, Cambridge, Mass.

NORTHERN CALIFORNIA—JAN. 10
San Francisco
Military Automotive Developments

NORTHWEST—JAN. 6
Bergonian Hotel, Seattle; Dinner 6:30 P.M.
Steels and Steel Testing

OREGON—JAN. 6
Multnomah Hotel, Portland; Dinner 6:30 P.M.

PHILADELPHIA—NO MEETING

PITTSBURGH—JAN. 12
Fort Pitt Hotel; Dinner 6:30 P.M.
New Methods of Measuring Riding-Comfort—Dr. F. A. Moss, Department of Psychology, George Washington University
Super-Balloon Tires—K. D. Smith, Technical Superintendent, B. F. Goodrich Co.

SOUTHERN CALIFORNIA—JAN. 6
Richfield Building Cafeteria, Los Angeles; Dinner 6:30 P.M.
Lubrication for Modern Engines—K. R. McPhail, Lubrication Engineer, Standard Oil Co. of California

SYRACUSE—NO MEETING

WASHINGTON—JAN. 18
Racquet Club, City of Washington; Dinner 6:30 P.M.

ing the Streamlining Session by a period of two days, is really an integral part of that session.

All Welcome at Student Session

Two entertaining and instructive addresses will be given at the Student Session, arranged by the Student Activity of the Detroit Section, under the direction of H. T. Woolson.

Dr. H. C. Rentschler, of the Westinghouse Lamp Co., will review briefly the entire spectrum of radiant energy, accompanying his talk by a large number of demonstrations.

B. E. Hutchinson, of the Chrysler Corp., plans to show what effect legislation may have upon the automotive industry, indicating the relation and the conflict, if any, between the railway and the motor-vehicle.

Problems for Engine Men

At the Diesel Engine Session, E. T. Vincent, of the Continental Aircraft Engine Co., and Max Hofmann, of the Waukesha Motor Co., will present papers.

Mr. Vincent will tell about the use of a high-speed engine indicator, not as an instrument to be employed in a research laboratory but as a routine test shop tool.

Mr. Hofmann's paper, after discussing the standing of modern Diesel fuel research, will emphasize its practical value for the automotive oil-engine designer and operator and will suggest a way leading to the ultimate standardization of ratings for such fuels.

The session on Aircraft Engines will include a paper by J. H. Geisse, consulting engineer, Madison, Wis., and three papers by representatives of the Pratt & Whitney Aircraft Co. and the United Aircraft & Transport Corp.

Mr. Geisse will present the results of an extensive study on the indirect air-cooling of aviation engines, including data obtained from tests on an engine that does not use a separate radiator, the jacket being provided with fins.

Of the three papers that are to follow the presentation of Mr. Geisse's material, the first will deal in a somewhat general way with the flight test equipment and methods in use by the United Aircraft & Transport Corp. The second of these papers will cover certain special flight test methods which have been developed in Hartford in the last year or two; these methods relate particularly to the powerplant. The third paper will deal largely with problems which have come up in the last year or two in connection with selection of propellers, and propeller behavior when supercharged engines are employed.

Another engine paper will be given at the General Session, when F. F. Kishline, of the Graham-Paige Motors Corp., will describe the advantages obtained from aluminum cylinder heads by raising the compression ratio an amount possible through having the aluminum material exposed in the combustion chamber. His paper will cover the necessary alterations in engine design in order to take full advantage of this change and will deal also with the subject of the actual function performed by the aluminum material in the combustion chamber.

One of the High Spots

The other paper at the General Session will be presented by Herbert Chase, consulting engineer, New York City. Some idea of the nature of his paper may be gained from its title, Pertinent Pokes for Satisfied Engineers, but it will be necessary to hear Mr. Chase deliver his paper in order to appreciate the punch behind the pokes and the degree of their pertinence.

Business Session

In addition to the election of the three members-at-large for next year's Nominating Committee and the announcement of the election of the 1933 officers of the Society, the Business Session will feature a most timely address by Presidential Nominee H. C. Dickinson, the subject of his talk being

ANNUAL MEETING PROGRAM

BOOK-CADILLAC HOTEL, DETROIT—JAN. 23 to 26

MONDAY, JAN. 23

Crystal Room

10:00 A.M.—TRANSPORTATION AND MAINTENANCE

A. S. McArthur, Chairman

Legislation Affecting Motor-Vehicle Transportation—T. R. Dahl, The White Co.

Crystal Room

2:00 P.M.—MOTORCOACHES AND MOTORTRUCKS

B. B. Bachman, Chairman

Rubber-Tired Rail-Coaches—Col. E. J. W. Ragsdale, Edward G. Budd Mfg. Co.

2:00 P.M.—TRIP AND DEMONSTRATION

A visit to the University of Detroit Aeronautic Laboratory

Grand Ball Room

8:00 P.M.—STUDENT SESSION

H. T. Woolson, Chairman

Sixty Octaves of Radiant Energy—Dr. H. C. Rentschler, Westinghouse Lamp Co.

The Automobile's Place in American Transportation—B. E. Hutchinson, Chrysler Corp.

TUESDAY, JAN. 24

Crystal Room

10:00 A.M.—DIESEL SESSION

A. J. Poole, Chairman

Testing with the Farnboro Electric Indicator—E. T. Vincent, Continental Aircraft Engine Co.

Fuels for High-Speed Oil Engines—Max Hofmann, Waukesha Motor Co.

Crystal Room

2:00 P.M.—AIRCRAFT ENGINES

P. B. Taylor, Chairman

Indirect Air-Cooling of Aviation Engines—J. H. Geisse, Consulting Engineer, Madison, Wis.

Commercial Flight-Test Equipment and Methods—A. L. MacClain, Pratt & Whitney Aircraft Co., and D. S. Hersey, United Aircraft & Transport Corp.

Airplane Flight Testing for Maximum Speed—F. M. Thomas and H. W. Fairchild, United Aircraft & Transport Corp.

Correlation of Propeller and Engine Power with Supercharging—F. W. Caldwell, Hamilton Standard Propeller Co., and F. M. Thomas, United Aircraft & Transport Corp.

Crystal Room

8:00 P.M.—BUSINESS SESSION

President A. J. Scaife, in the Chair

Nomination and Election of Members-at-Large of Annual Nominating Committee

Announcement of Election of Officers for 1933

A Philosophy of Economics—Presidential Nominee H. C. Dickinson

Crystal Room

9:00 P.M.—AIRCRAFT SESSION

W. B. Stout, Chairman

Air Transportation Systems of the United States—Col. C. M. Young, Assistant Secretary of Commerce

WEDNESDAY, JAN. 25

Italian Garden

10:00 A.M.—BODY SESSION

R. F. Anderson, Chairman

Cushion Springs and Riding Comfort—F. R. Atkinson, Atkinson Spring Co.

Results Gained from Foreign Designs—Amos E. Northup, Murray Corp. of America

Crystal Room

10:00 A.M.—PASSENGER CARS

Alex Taub, Chairman

Pertinent Pokes for Satisfied Engineers—Herbert Chase, Consulting Engineer, New York City

Aluminum Cylinder Heads—F. F. Kishline, Graham-Paige Motors Corp.

Crystal Room

2:00 P.M.—CHASSIS SESSION

P. L. Tenney, Chairman

The Future of Low-Pressure Balloon Tires—A. F. Denham, *Automotive Industries*

Automatic Transmissions—W. C. Keys, Consulting Engineer, Detroit

The New A-B-C in Clutch Design—E. E. Wemp, Long Mfg. Co.

Crystal Room

8:00 P.M.—STREAMLINING SESSION

W. C. Keys, Chairman

What Price Standardization?—W. T. Fishleigh, Consulting Engineer, Detroit

50 Miles per Gallon with Correct Streamlining?—W. E. Lay, University of Michigan; Charles D. Holton and Robert B. Patterson

THURSDAY, JAN. 26

Crystal Room

10:00 A.M.—RIDING-QUALITIES

R. W. Brown, Chairman

Final Report on Riding-Qualities—Dr. F. A. Moss, The George Washington University

Inertia-Control Shock-Absorbers—Carl Kindl, Delco Products Corp.

English Grill

12:00 NOON—PRODUCTION LUNCHEON

R. A. Vail, Chairman

Production, a Human Equation—K. T. Keller, Chrysler Corp.

Italian Garden

2:00 P.M.—PRODUCTION SESSION

V. P. Rumely, Chairman

Some Principles of Flexible, Accurate, Low-Cost Tooling—J. E. Padgett, Spicer Mfg. Corp.

Automotive Aspects of Work of the Committee on Rehabilitation of Industry—Col. James L. Walsh, Guardian Detroit Union Co.

Crystal Room

2:00 P.M.—FUELS AND LUBRICANTS

J. B. Macauley, Chairman

The Vapor-Handling Capacity of Automobile Fuel-Systems—O. C. Bridgeman, H. S. White and F. B. Gary, Bureau of Standards

Correlation of C.F.R. Laboratory Knock Rating with Behavior of Motor Fuels in Service—C. B. Veal, Society of Automotive Engineers; H. W. Best, Yale University; J. M. Campbell, General Motors Research Laboratories, and W. M. Holaday, Standard Oil Co. (Indiana)

The Load-Carrying Capacity of Extreme-Pressure Lubricants—S. A. McKee, Bureau of Standards

Friction Data in the Region of Thin-Film Lubrication—O. C. Bridgeman, Bureau of Standards

Grand Ball Room

7:00 P.M.—DINNER

Detroit Section acting as host to the National Society

A Philosophy of Economics. Dr. Dickinson will discuss five fundamental concepts in the field of economics, showing how their application would simplify the complex problems in this field.

Aircraft

Col. Clarence M. Young, Assistant Secretary of Commerce, who has consented to be the speaker at the Aircraft Session, will discuss air transportation systems of the United States.

Chassis and Bodies

Announcing his paper under the provocative title, What Price Standardization, Walter T. Fishleigh, consulting engineer, Detroit, will look standardization straight in the face and tell what is right with it and also what is wrong with it.

Prof. W. E. Lay, of the University of Michigan, will present at the same session a paper which he has prepared with the collaboration of Charles D. Holton and Robert B. Patterson, graduate students of the University of Michigan. This paper is a discussion of the general air-resistance problem, dealing with the factors included in air resistance and the conditions of operation of a motor-vehicle in an "air ocean," or factors affecting the resisting forces; methods of test on small-scale models in the wind tunnel and test methods for full-sized bodies; streamlining versus the public conception of beauty; improvement in the last two decades, and the possibilities of the future.

A. F. Denham, of *Automotive Industries*, in his paper on The Future of Low-Pressure Balloon Tires, will deal with a topic that is of vital interest at this time.

Walter C. Keys, consulting engineer, Detroit, will present a wealth of information on automatic transmissions.

E. E. Wemp's topic, The New A-B-C in Clutch Design, becomes particularly significant when it is known that "A" represents "automatic clutches"; "B" stands for "basic improvements in conventional clutches"; and "C" for "clutch control."

Body engineers will find much for their interest and profit at the session at which F. R. Atkinson, of the Atkinson Spring Co., will discuss cushion springs and riding comfort, and A. E. Northup, of the Murray Corp. of America, will tell about results gained from foreign designs.

Luncheon and Session for Production Men

K. T. Keller, of the Chrysler Corp., will be the speaker at the Production Luncheon, and a rare treat is in store for all who on that occasion will have the opportunity of hearing him discuss Production, a Human Equation.

J. E. Padgett, of the Spicer Mfg. Co., will be the first speaker at the Production Session, immediately following the luncheon. Mr. Padgett, who is the Society's Vice-President representing Production Engineering, will talk on Flexible, Accurate, Low-Cost Tooling, showing ways to help the shop make changes easily and at low cost; he will also point out the proper field for the complete machine and the work that can be most profitably done by the tool or fixture attached to the machine.

Col. James L. Walsh, Vice-President of the Guardian Detroit Union Co., and Chairman of the Michigan District of the National Rehabilitation Committee, will relate some interesting automotive aspects of the work of the Committee.

Two Research Sessions

Dr. F. A. Moss, of the George Washington University, will present at the Riding-Qualities Research Session, his final report on his riding-qualities investigation, embodying the results of an intensive study covering a period of three years.

Carl Kindl, of the Delco Products Corp., will give a brief description of the performance of the present-day conventional shock-absorbers; a description of the inertia shock-absorber operation with performance diagrams showing the car oscillations and a comparison of the car performance with inertia control and conventional shock-absorbers; and a summary of the factors involved in riding comfort but not subject to the control of the shock-absorbers.

Four papers have been scheduled for the Fuels and Lubricants Research Session. In his paper entitled The Vapor-Handling Capacity of Automobile Fuel Systems, Dr. O. C. Bridgeman, of the Bureau of Standards, will give the results of a series of road tests, conducted during the past summer on 50 cars, presenting these results from the standpoint of the gasoline vapor pressures which would cause vapor lock.

The paper by Messrs. Veal, Best, Campbell and Holaday comprises the report of the Detonation Subcommittee of the Cooperative Fuel Research Committee.

The Load-Carrying Capacity of Extreme-Pressure Lubricants, a paper by S. A. McKee, of the Bureau of Standards, presents the results of testing a number of lubricants, showing how the load-carrying capacity varies with speed and heat.

A paper prepared by Dr. O. C. Bridgeman, of the Bureau of Standards, discusses friction data in the region of thin-film lubrication.

Reduced Fares for Meetings in New York City and Detroit

Reduced-fare railroad certificates, entitling members to the fare-and-a-half rate, were mailed with the Bulletin, the middle of December. This reduced-fare privilege was granted to S.A.E. members who wish to attend the Business Meeting of the Society in connection with the Annual Dinner in New York City on Jan. 11 and to attend the Annual Meeting of the Society in Detroit, Jan. 23 to 26. Members are urged to consult their local ticket agents regarding dates when tickets may be bought and periods during which they will be effective, inasmuch as these items vary in different localities.

Members who use the certificate to attend either of these meetings must have their tickets validated before returning home. Those attending the Business Meeting in New York City can have their tickets validated at the Hotel Pennsylvania at the time of the meeting. Validation for members attending the Annual Meeting in Detroit will be taken care of at the Book-Cadillac Hotel. Members who use the certificate to attend the Business Meeting in New York City, Jan. 11, and who wish another certificate entitling them to the reduced-fare privilege for the Annual Meeting in Detroit should write promptly to S.A.E. headquarters asking for another reduced-fare certificate.

S.A.E. TO MEET WITH ROADBUILDERS

Lack of regulatory uniformity and its effect upon design of automotive equipment will be the main topics of interest at an S.A.E. session that is to be held at Detroit Municipal Airport on Jan. 18 as a part of the Highway and Road Building Congress and Convention. Sponsored mainly by the American Road Builders' Association, with some 34 allied organizations participating, the Congress, Road Show, cooperative meetings and other events that are to take place in Detroit between Jan. 16 and 20, will attract many Society members. Detailed information will be found on p. 28.

THE PAST year has been a time of search and research, leading to economies and efficiencies in the operation of your Society which would have been considered impossible a few years ago. The able headquarters staff is to be congratulated for the very fine spirit of cooperation manifested in these trying times in making these economies effective, and at the same time giving the members of the Society the services to which they are entitled.

Your Council has striven to maintain the normal operations of the Society consistent with present conditions and, thanks to the cooperation of our loyal membership, it has been possible to make these policies effective.

One of the most difficult problems has been, and is, that of taking care of the members in distress. Your Council has spent considerable time on this problem, and it *is* a problem, one in which we are vitally interested,—that of helping the other fellow in time of great need. I cannot urge too strenuously the cooperation of every member in this respect.

It would be ungrateful of me if I did not express my appreciation of the very fine spirit and assistance of the Sections and their official staffs, as well as the splendid work accomplished by many of the members represented on the numerous and varied committees throughout the Society. Neither do I hesitate to invite your attention to the progressive spirit of your officers as reflected in this issue of the Journal. Not only has it a new outer garment, but the entire set-up has been changed as to type and style, manifesting a forward-looking and forward-moving condition, which is in line with the spirit of progress, regardless of retarding influences prevalent in this day.

I take this opportunity to extend to all of the members of the Society a most cordial greeting, hoping that the spirit of the Holiday Season may be with you throughout the year.

A. J. Scaife

President

CHRONICLE & COMMENT

A New Year—A New Journal

In presenting the JOURNAL with new cover and improved typographical treatment, our officers give further evidence of their forward-moving spirit and their determination that the Society's official publication shall maintain the position of leadership that it has enjoyed for many years. And pleasing it is to have this 1933 Model of the JOURNAL appear concurrently with the attractive new automotive offerings of our membership, which are described in this issue.

Our new cover was designed by Comstock, an artist of distinction in the field of book and magazine craftsmanship. According to competent critics, among them scores of our own engineers to whom a number of designs were submitted, Comstock succeeded best in his efforts to combine the essential elements of beauty and simple dignity with the colorful strength and vitality that characterize the engineering creations of our industry.

In cooperation with Van R. Pavey and members of the Society's staff, Mr. Comstock has also established the new format. For text type, Granjon is used because of its beauty, clear form and legibility. A modern design, based upon French book faces of the 16th Century, it is named after the famous French cutter who flourished during that period and who cut type for the leading printers of Paris, Lyons, Antwerp and for the Vatican Printing Office at Rome. Heads are done in Garamond, another contemporary face that is backed by the tradition of a distinguished lineage.

Marking the first step in a progressive program for 1933, the improved JOURNAL typifies many attractive advancements that are to come.

This Issue Has Two Sections

In accordance with the usual practice, this issue of the S.A.E. JOURNAL is made up of two Sections, Section 1 being the regular monthly issue for January and Section 2 the Index to Vol. 31, covering the issues from July to December, 1932, inclusive.

January Meetings, Dinners, Shows and Low Fares

Through the efforts of our officers, members will benefit by a reduction in railroad fares to New York City and Detroit for the period of important January events of the S.A.E. and other organizations.

During Show Week in New York, the Metropolitan Section will swing its popular Show Dinner into full effect on Monday evening, Jan. 9.

Our Annual Dinner will allow hundreds of members to hear Kettering, Gherardi, Faulkner, Werrenrath and Goldberg on Wednesday evening, Jan. 11.

Then comes the Annual Meeting in Detroit, Jan. 23 to 26.

Our Chicago Section is planning an attractive Show Dinner for Jan. 31.

A great month for automotive engineers, and reduced rates will prevail!

President Scaife's Record

During his tenure of office at the head of our Society, President Scaife has accomplished great things. Demands upon his time and energy have been unusually heavy but he has never failed of a generous response. Every general meeting has been attended by him, and by the time of his retirement he will have visited all but 1 or 2 of our 22 Sections at least once. These and many other significant features of his personal administration are the subjects of sincere approval of our membership.

Presidential Economics

A most interesting, rational and important economic study, inspired by world affairs, has been developed over a period of years by our own Presidential Nominee. Dr. Dickinson's concepts and observations together with suggested methods of economic control have already won favorable recognition from many sources. They will be brought to light at the Annual Meeting for full consideration by our members. Dr. Dickinson expects also to discuss this vital subject with Section members who will be privileged to meet him during his administrative year.

Should Engineers Help Us Out?

Vice-President Stout illustrates his contention that engineers can and should help to bring order out of chaos by a parallel which involves an automobile, representing Civilization, in which a Banker, a Bishop, a General and an Engineer are riding. Something goes wrong with Civilization. The occupants get out and start immediately to function. The banker figures and philosophizes; the bishop offers a fervent prayer; the general wants to fight it out; the engineer repairs the distributor. Civilization goes forward!

Dinner Date Changed

The 1933 Annual Dinner will be held on the evening of Wednesday, Jan. 11. As previously announced, the Dinner will be staged at the Hotel Pennsylvania, New York City; the only change from the earlier announcement has to do with the date. The Committee believes that the holding of the Dinner on Wednesday evening, which is earlier in the week than the date originally announced, will be advantageous in that it will enable many members to be present who otherwise would have been unable to attend.

Low Bodies and High Hats

It isn't at all clear, but news accounts from the City of Washington indicate that a cabinet officer, in answer to Congressional questioning, stated that $1,700 and eight used cars were exchanged by his department for a new car which, it developed, had insufficient clearance for a man of normal size wearing a silk hat. Without delving into the accuracy of these reports and certainly without taking sides, it seems that the situation might well be considered in the light of its engineering significance.

Certainly, our body engineers would argue that modern cars should not be designed around high hats. But, undoubtedly, many intelligent "prospects" could be found possessed of the idea that the exigencies of what someone has called "low-down" engineering should be more adequately tempered by the headroom requirements of persons *without* high hats.

AUTOMOTIVE RESEARCH

What Quality E-P Lubricants?

COL. H. M. ALDEN

THE GENERAL trend in automobile design during the last several years toward lower body styles, higher speed and greater acceleration has resulted in the use of smaller axles and hypoid gears. The new types of gearing and the increase in the horsepower transmitted, without corresponding increase in gear size, has in turn resulted in higher tooth pressures and necessitated the use of lubricants capable of sustaining greater loads than will ordinary mineral oils.

In answer to this need, new types of lubricants having various load-carrying capacities have been developed and many laboratory machines have been designed for testing the characteristics of these lubricants. However, up to the present, the only truly satisfactory test has consisted in making service runs, an expensive and time-consuming process. The lack of reproducible and significant test methods has become a serious problem.

A number of the oil refiners and manufacturers of motor-vehicles and component parts have been working on this subject for several years. Extreme-pressure lubricants were discussed[1] at the Detroit regional meeting of the American Society for Testing Materials in March, 1930, and two papers[2] on this subject were presented at the November, 1930, meeting of the Cleveland Section of the Society of Automotive Engineers.

As a result of the interest shown at the latter meeting, the Research Committee of the Society, at a meeting held in Detroit on Jan. 23, 1931,

[1] See the Significant Properties of Automotive Lubricants, Detroit regional meeting, American Society for Testing Materials, March 19, 1930, Symposium on Developments in Automotive Materials, p. 127.

[2] See S.A.E. JOURNAL, January, 1931, pp. 50 and 53.

Variations of Load-Carrying Capacity with Temperature and Rubbing Speed Tested

appointed a subcommittee to investigate the general subject of extreme-pressure lubricants. On the basis of the recommendations of that group, the Lubricants Research Subcommittee was formed in the latter part of 1931. It is comprised of six groups representing the interested branches in the automotive and petroleum industries; namely, automobile, axle and transmission, bearings, oils, operators and truck groups. Col. H. W. Alden, of the Timken-Detroit Axle Co., was elected to serve as Chairman, with Dr. H. C. Dickinson, of the Bureau of Standards, as Secretary. To expedite the work there was organized an executive committee composed of the Chairman, Secretary and chairmen of each of the sub-groups.

A research program was formulated, a fund subscribed by individual company contributions, and the work undertaken at the Bureau of Standards under the immediate direction of Dr. O. C. Bridgeman, with the guidance of this Subcommittee. An executive committee meeting was held in Cleveland on March 8, 1932, and a meeting of the entire group in Detroit on April 7 at which time the problem and program were more clearly established. At the outset of the project it was agreed that the general problem should be studied under the following subheadings:

(1) Load-carrying capacity before seizure
(2) Tendency to cause wear or abrasion
(3) Corrosiveness
(4) Stability, both in storage and in service

Since other properties of extreme-pressure lubricants are of no interest if the lubricants have not the desired load-carrying capacity, the Subcommittee suggested that the Bureau first undertake the development or standardization of a method for measuring this property.

Detailed Program

(1) Measurement of the load-carrying capacity of representative types of lubricant to be selected by the Oils Group of the Committee, with the General Motors, Timken and other machines, following the procedure recommended by the designers.

(2) Correlation of these data with actual service performance.

(3) Development or recommendation of a significant and practical test machine and procedure.

Problems of wear, corrosiveness and stability or permanence were deferred until later. As a basis for further development work on a test apparatus and procedure for determining load-carrying capacity, the Bureau was requested to make comparative tests on a number of available machines, operated according to the recommendations of the manufacturers. For these tests, the Oils Group of the Lubricants Research Subcommittee chose a number of lubricants as representative of the various types of extreme-pressure lubricants.

O. C. BRIDGEMAN

Load Capacity Varies with Temperature and Rubbing Speed

Results of the tests showed that comparable values were not obtained on these machines and that the lubricants were rated in different orders by the various machines. One of the outstanding differences between the operating conditions of the machines was in the rubbing speed, which varied from 6 to 400 ft. per min. Other differences were in the composition of the test specimens and in the rate of heat conduction away from the oil film between the rubbing surfaces.

For the purpose of studying the effect of these differences on load-carrying capacity, machines of the two diverse types were arranged for operation at various speeds and oil temperatures. Data have been obtained on the representative extreme-pressure lubricants over a wide speed range and at oil temperatures from 25 to 125 deg. cent., with the result that the load-carrying capacity has been found to decrease as the temperature increases and also as the rubbing speed increases.

Because of the result of these tests, a machine has been designed that will simulate conditions encountered in gears in service and enable the measurement of load-carrying capacity over a wide speed range, with varying ratios of rubbing to rolling motion at each speed, and over a wide temperature range, with any desired combinations of metals rubbing against each other.

Results of tests made with this machine will be reported in detail by S. A. McKee, of the Bureau of Standards, in his paper entitled The Load-Carrying Capacity of Extreme-Pressure Lubricants, scheduled for presentation at the forthcoming Annual Meeting.

STANDARDIZATION PROGRESS

Standardization Projects Nearing Completion for Adoption at the S.A.E. Annual Meeting

AS THIS administrative year of the Society closes, a number of projects in Divisions of the Standards Committee are nearing completion for final approval at the Annual Meeting. Among the projects that are before the Standards Committee for final action are the following:

Aircraft Division

The Society is represented on and follows closely the work of the Army and Navy Standards Conference in connection with aircraft. As the result of the A-N Conferences last September a few changes, not of major proportions, in the following S.A.E. aircraft specifications are being acted on for approval by the Society:

Instrument Cases and Mountings
Aluminum and Aluminum Alloy Rivets
Plain Hexagon Head Bolts
Flat Washers

Minor errors in the specifications for Rigid Terminals, Extruded Structural Shapes and Non-Metallic Pulleys are being rectified.

Ball and Roller Bearings Division

Probably the most far-reaching subject that is coming through this Division is the proposal to adopt the metric conversion factor 25.4 mm. equals 1 in. as the general industrial standard in this Country, it being understood that the exact conversion 25.40005 will be used only for scientific or the most exact conversions not ordinarily used in industrial application. This recommendation is being acted on as the result of a general industrial conference held in New York City last October at which it was recommended that the factor 25.4 be generally approved and adopted for industrial purposes.

Reports have been submitted on a standard series of steering-knuckle thrust bearings including both ball and roller types, a revised report on ball-bearing lock nuts and washers and a new standard numbering system for taper roller bearings. With the exception of one size, the taper roller bearing dimensions as now published in the S.A.E. HANDBOOK, will remain the same.

In connection with the work of the Sectional Committee on Ball Bearings, the tables of angular contact type ball bearings are being extended to include larger sizes in the light, medium and heavy series corresponding in bores and outside diameters with the present American and international standards for single-row annular bearings. A report is also being submitted for adoption as an American Standard on adapter-sleeve bearings, for line-shafts and industrial applications.

Electrical Equipment Division

A Subdivision of this Division has been working for some time on revisions that will bring the S.A.E. Standard for Insulated Wire and Cable thoroughly up to date. At the time of preparing this article it was expected that the Subdivision's report will be ready for submission to the Division and for final approval at the Annual Meeting.

Iron and Steel Division

This Division is reporting one minor modification in the present standard definitions of terms relating to heat-treatment operations in the steel specifications and the addition of a second grade of malleable iron castings corresponding to No. 35018 of the American Society for Testing Materials. Two important projects that are in progress but not yet ready for adoption are gray iron specifications and a standard telegraphic code for S.A.E. steels.

Lighting Division

The only subject on which a report of this Division is expected is the revised specification for automobile headlighting. This work is in progress jointly with the Motor Vehicle Lighting Committee of the Illuminating Engineering Society, and a Subcommittee is completing its recommendations that will bring the headlighting specifications thoroughly up to date to supersede those at present printed in the S.A.E. HANDBOOK.

Lubricants Division

When the information on freewheeling transmission lubricant viscosity numbers was approved last June for publication, it was understood that this classification would be reviewed by the Lubricant Division just prior to the Annual Meeting this month, looking to its adoption by the Society as S.A.E. Recommended Practice. A meeting of the Lubricants Division will be held just prior to the Annual Meeting and the recommendations of the Division at that time will be submitted to the Standards Committee and Council for approval.

Motorcoach and Motor-Truck Division

For several years this Division has been working with the trailer manufacturers for standardization that will provide for coupling interchangeability between semi-trailers and their tractors. Although some progress has been made in this project, no recommendations are as yet ready. The Division is, however, recommending the adoption of two sizes of pintle eyes for four or six-wheel trailers that will make practically all trailer couplings interchangeable with the pintle hooks that are being used on tractor trucks.

Non-Ferrous Metals Division

A comprehensive review of the present S.A.E. non-ferrous metals specifications was undertaken by the Division last spring and a number of proposed changes in the present brass and copper alloys group are being recommended by the Division. A similar review of the several S.A.E. aluminum specifications is in progress and general notes and information on both of these groups of alloys will eventually be included in the S.A.E. HANDBOOK.

Screw-Threads Division

About two years ago it was suggested that a standard be formulated for acorn or cap nuts inasmuch as there was little uniformity among them and as the majority of this type of nuts are used in the automotive industry. The Division surveyed the industry and as a result of considerable study and correspondence prepared a recommendation for cap nuts ranging in size from No. 6 to 1¼ in. diameters.

One of the most important projects under consideration this year is the American Standard for Wrench Head Bolts and Nuts and Wrench Openings. The Sectional Committee on Bolts, Nuts and Rivet Proportions for which the Society and the American Society of Mechanical Engineers are sponsors under the procedure of the American Standards Association, has given the revision of this standard very careful consideration with the cooperation of the Society and various industrial groups that are interested in this standard. Although there are still some features of the report that are not entirely acceptable, it is the consensus of opinion that a material step forward has been made toward an ultimate standard and the report has accordingly been passed for approval and acceptance. The principal changes that will result in the S.A.E. Standards for Bolts and Nuts are shown in Table 1.

The revised American Standard now being approved contains 18 tables of detailed dimensions and will be issued as soon as possible after its final approval by the American Standards Association. A general summary of the standard, however, is shown in Table 2 that is reproduced from the proposed American Standard.

Publication of Standards

All of the new and revised specifications that are being submitted by Divisions of the Standards Committee will, upon their approval by the Standards Committee and Council at the Annual Meeting of the Society this month, be prepared fo publication in the next edition of the S.A.E. HANDBOOK. The Divisions of the Standards Committee have worked this year under the new Standards Committee Regulations that were adopted in the early part of the year and have made it possible to expedite much of the work notwithstanding the difficulties encountered due to the economic conditions the industry has been passing through. On the whole it is felt that the recommendations of the several Divisions are improvements in the standards and recommended practices established through the Society and that their prompt adoption and use by the automotive and allied industries will be definitely beneficial to them.

TABLE I—VARIATIONS FOR S.A.E. BOLT HEADS AND NUTS

Nut Size	Width Across Flats S.A.E.	Width Across Flats Proposed	Nut Thickness S.A.E.	Nut Thickness Proposed
9/16	⅞	Same	½	31/64
⅝	1	15/16	35/64	Same
¾	1-⅛	1-1/16	21/32	Same
⅞	1-5/16	1-¼	49/64	Same
1	1-½	1-7/16	⅞	Same
1-⅛	1-11/16	1-⅝	1	63/64
1-¼	1-⅞	1-13/16	1-3/32	Same
1-⅜	not included	2	not included	1-13/64
1-½	2-¼	2-3/16	1-5/16	Same

NEW BY-LAW APPROVED

Council Makes New Standards Committee Regulations Fully Effective

When the new Standards Committee Regulations, the adoption of which is referred to in this issue of THE JOURNAL, were prepared by the Standardization Policy Committee last year, the provisions therein included some that are different from the provisions in the Constitution and By-Laws relating to the Society's procedure.

With the approval and adoption of the new regulations, the following new By-Law was approved by the Council at its meeting on Dec. 12 in accordance with the provisions of the Constitution for amending the By-Laws, to make the new regulations authoritative.

"By-Law B-47. The organization, procedure and determinations of the Standards Committee and its Divisions and of other Committees concerned with standards shall be governed by the Standards Committee Regulations."

TABLE 2—REGULAR, HEAVY AND LIGHT SERIES BOLTS AND NUTS

Nominal Size of Wrench also Basic Width Across Flats, Bolt Heads and Nuts		Allowance between Nut or Bolt Head and Jaws of Wrench	Nominal Bolt Diameter						
			Regular Series		Heavy Series	Light Series			
			Bolts *Unfinished and Semi-finished*	Bolts, *Finished* — Nuts and Jam Nuts, *Unfinished Semi-finished and Finished*	Bolts, Nuts and Jam Nuts *Unfinished Semi-finished and Finished*	and Castle Nuts	Cap Screws	Set Screws	Machine-Screw Nuts and Stove-Bolt Nuts
									No's
5/32	0.1562	0.002	...	...	...	...	...	...	0 1
3/16	0.1875	0.002	...	...	...	...	...	...	2 3
1/4	0.2500	0.002	...	...	...	...	...	1/4	4
5/16	0.3125	0.003	...	...	...	...	...	5/16	5 6
11/32	0.3437	0.003	...	...	...	...	...	...	8
3/8	0.3750	0.003	1/4	...	...	...	...	3/8	10
7/16	0.4375	0.003	...	1/4	...	1/4	1/4	7/16	12 1/4
1/2	0.5000	0.003	5/16	...	...	5/16	5/16	1/2	...
9/16	0.5625	0.004	3/8	5/16	...	3/8	3/8	9/16 5/8	5/16"
5/8	0.6250	0.004	7/16	3/8	...	7/16	7/16		3/8"
3/4	0.7500	0.005	1/2	7/16 1/2	...	1/2	1/2	3/4	
13/16	0.8125	0.005	...	...	...	...	9/16	...	
7/8	0.8750	0.005	9/16	9/16	1/2	9/16	5/8	7/8	
15/16	0.9375	0.006	5/8	...	9/16	5/8	...	...	
1	1.0000	0.006	...	5/8	...	...	3/4	1	
1 1/16	1.0625	0.006	...	...	5/8	3/4	...	...	
1 1/8	1.1250	0.007	3/4	3/4	...	...	7/8	1 1/8	
1 1/4	1.2500	0.007	...	...	3/4	7/8	...	1 1/4	
1 5/16	1.3125	0.008	7/8	7/8	...	...	1	...	
1 3/8	1.3750	0.008	...	...	...	...	...	1 3/8	
1 7/16	1.4375	0.008	...	...	7/8	1	...	...	
1 1/2	1.5000	0.008	1	1	...	...	1 1/8	1 1/2	
1 5/8	1.6250	0.009	...	...	1	1 1/8	...		
1 11/16	1.6875	0.009	1 1/8	1 1/8	...	...	1 1/4		
1 13/16	1.8125	0.010	...	...	1 1/8	1 1/4			
1 7/8	1.8750	0.010	1 1/4	1 1/4	...	...			
2	2.0000	0.011	...	...	1 1/4	1 3/8			
2 1/16	2.0625	0.011	1 3/8	1 3/8	...	...			
2 1/8	2.1875	0.012	...	...	1 3/8	1 1/2			
2 1/4	2.2500	0.012	1 1/2	1 1/2	...	...			
2 3/8	2.3750	0.013	...	...	1 1/2	...			
2 7/16	2.4375	0.013	1 5/8	1 5/8	...				
2 9/16	2.5625	0.013	...	...	1 5/8				
2 5/8	2.6250	0.014	1 3/4	1 3/4	...				
2 3/4	2.7500	0.015	...	...	1 3/4				
2 13/16	2.8125	0.015	1 7/8	1 7/8	...				
2 15/16	2.9375	0.016	...	...	1 7/8				
3	3.0000	0.016	2	2	...				
3 1/8	3.1250	0.017	...	...	2				
3 3/8	3.3750	0.018	2 1/4	2 1/4	...				
3 1/2	3.5000	0.018	...	...	2 1/4				
3 3/4	3.7500	0.020	2 1/2	2 1/2	...				
3 7/8	3.8750	0.020	...	...	2 1/2				
4 1/8	4.1250	0.021	2 3/4	2 3/4	...				
4 1/4	4.2500	0.022	...	...	2 3/4				
4 1/2	4.5000	0.023	3	3	...				
4 5/8	4.6250	0.024	...	...	3				
5	5.0000	0.026	...	...	3 1/4				
5 3/8	5.3750	0.028	...	...	3 1/2				
5 3/4	5.7500	0.030	...	...	3 3/4				
6 1/8	6.1250	0.032	...	...	4				

All dimensions given in inches.

NOTES AND FORMULAS

Wrenches shall be marked with the "Nominal Size of Wrench" which is equal to the basic (max.) width across flats of the corresponding bolt head or nut.

Allowance (minimum clearance) between nut or bolt head and jaws of wrench equals (0.005 W + 0.001) inches. Tolerance on wrench opening equals (0.005 W + 0.004) inches.

Note—Wrench opening limits are included in the proposed American Standard.

Provisions of New Regulations

The new Regulations, which have already demonstrated their value over the previous ones in expediting and simplifying the work, include the following provisions that are different from the old.

The Standards Committee now consists of its Chairman and the Chairmen of the several Divisions rather than all members of all the Divisions. Being composed of the Chairmen of the various Divisions, the Committee is representative of all classifications of the regular standards work in the Society.

The Regulations now provide that all grades of members of the Society have voting privilege on Divisions whereas no provision in this respect was made in the old Regulations, and under strict procedure according to the Constitution and By-Laws, only voting members of the Society would have had voting power. The term Consulting Member is now used instead of Conferee for non-members of the Society serving on Divisions.

New subjects are now assigned to Divisions by the Standards Committee rather than by the Council inasmuch as the Standards Committee, which is composed of the Division Chairmen, is in a better position to determine such assignments. This relieves the Council of considerable unnecessary routine work and affords a better review of proposed new subjects by the Committees that are directly concerned with their standardization.

Under the old Regulations, a quorum consisted of a majority of the voting members of a Division and many meetings accordingly were held without a quorum present. The new Regulations provide that three voting members of a Division shall constitute a quorum and practically assures that all Division meetings will be regular. One of the cardinal principles of the Society's standardization work is that standards should be adopted as nearly as possible by unanimous approval. The new Regulations provide for approval by two-thirds of the voting members for the adoption of a report, instead of by a majority vote as previously.

Special or interim meetings of the Standards Committee may be called by the Council or by the Standards Committee Chairman instead of by the Council only, as under the old Regulations. This simplifies and expedites the calling of such meetings where the importance or urgency of work in progress might require. Provision has also been made for approval of Division reports by the Standards Committee by letter-ballot, whereas under the old Regulations all reports recommended by Divisions were acted on only twice a year by the Standards Committee and Council. Provision has also been made for assuming the approval of minutes of meetings by members of the Committee within specified time limits if such members have not indicated such approval in writing within that time. This provision avoids undue delay and frequently two or three follow-ups to secure the necessary number of confirmations and approvals of actions taken at meetings.

The new Standards Committee Regulations as approved by the Council on June 15 last year, and under which the Standards Committee and Divisions have been functioning during the year, were printed on pp. 664a to 664f inclusive of the July, 1932, Supplement to the S.A.E. HANDBOOK that was sent to all members of the Society. These new Regulations make it possible for the Society to give quicker and better consideration to projects that are of more than automotive interest and to expedite its approval of such projects so far as the automotive industry is concerned, in their progress toward approval and adoption as American and international standards.

TRANSPORTATION ENGINEERING

Oil-Reclamation Economics

By GEORGE T. HOOK

A HUNT was instituted by the author of this Transportation Meeting paper for impartial answers to the following questions:

(1) What is the effect of reclaimed oil on the engine?
(2) How much are operators, who use reclaimers, saving in the cost of oil?
(3) How many vehicles must a fleet operate or how many gallons of oil drainage must it have in a given period to show a profit on the investment?

Mr. Hook first stated that determining the effect of reclaimed oil on an engine is necessary because, if the effect is harmful, how much one can save in the cost of oil does not matter. A bad effect would mean an increase in maintenance costs that would wipe out the savings in oil costs. One must bear in mind the relative importance of, say, a 1-per-cent oil-cost item and a 35-per-cent maintenance item. A 2-per-cent *increase* in the maintenance item will completely swallow a 50-per-cent *decrease* in the oil item.

To answer the question satisfactorily, continued the author, we must first determine whether reclaimed oil is as good as the original oil. Evidence that it is as good has accumulated from unbiased sources to such an extent that hardly any room for an argument exists. Substantiation comes from such different and authoritative sources as oil refiners themselves, the Bureau of Standards, college research laboratories and from local chemists acting for fleet operators. Some of the statements even suggest that the reclaimed oil is a better oil because of the process it undergoes.

According to oil refiners, actual loss of lubricating ability does not occur in engine service. Lubricating ability of an oil is counteracted only by the development of non-lubricating matter in the engine during operation. Since the function of the oil reclaimer is to remove such non-lubricating matter and simply restore lubricating ability, no reason exists why the reclaimed oil should not possess the lubricating characteristics of the original oil. This being so, the effect of the reclaimed oil on the engine is at least as good as, and not any worse than, that of the original oil. Mr. Hook phrased this conclusion in that fashion because, if the original oil is not the proper lubricant, putting it through a reclaimer will not make it the proper lubricant.

Continuing, Mr. Hook stated that the maintenance-cost experience of a very large fleet operation in the East lends supporting evidence to the foregoing conclusion. In this operation, in which only reclaimed oil is used, no effect on engine maintenance has been noticed. The reason advanced for this was that when new oil was used, without reclaiming, crankcases were drained at frequent intervals, averaging 500 miles, and this period was not changed when oil reclaiming was started. In this operation, therefore, the effect of reclaiming is to reduce oil cost, not to reduce maintenance costs; however, the fact that maintenance costs did not increase or change at all with the use of reclaimed oil seems to prove that reclaimed oil is a satisfactory lubricant and has no harmful effect on an engine.

[The author is the editor, *Commercial Car Journal*, Philadelphia.]

Analyzing Data Obtained from Questioning Motor-Vehicle Fleet Operators

An even more encouraging experience of a large fleet in Philadelphia is that three years ago a reclaimer was installed and, at the same time, drainage periods which ranged from 1000 to 1500 miles were changed to a 500-mile basis. The low cost of the reclaimed oil—around 12 cents per gal.—made increasing the drainage frequency economical. The result was that, whereas 15 general engine overhauls per year were made in a fleet of 25 trucks, only eight engines are rebuilt in an active fleet of 70 trucks today. In this case the distinction that the maintenance economies were the result of frequent oil change in spite of the use of reclaimed oil, could not be made, but reclaimed oil must at least share the credit for the maintenance economies because it encouraged frequent crankcase changes. The manager of this fleet gives all the credit to the reclaimer because it enabled him to maintain in his engines an oil of a better average quality. He said he expects to get 100,000 miles out of his engines.

The foregoing expectation is not a vain one. Other fleet operators are not only expecting it but also apparently getting it. For example, an Ohio motorcoach fleet that has been experimenting with reclaimed oil has one parlor car which has operated 187,000 miles and still has the original block without any regrinding and has the original pistons, pins and rods. Only one ring replacement was made, and that at 96,000 miles. The vehicle operates 372 miles daily and averages only 2 qt. of oil used each day. "This is still another piece of equipment that is showing up a wonderful record," the manager writes. "If reclaimed oil was not 100 per cent suitable, our equipment would never be showing such records."

Other Experiences Cited

Installation of a reclaimer permitted the Detroit Water Supply Department to change oil at more frequent intervals and also use a higher quality of oil than that used by the other departments in the city. "In addition to the actual saving in the oil purchases," the garage superintendent writes, "our maintenance costs have been noticeably reduced since the installation of the reclaimer."

Speaking at a Retail Delivery Association meeting, J. R. Kreisa, of the Coca Cola Bottling Co., of New York City, said:

"The economies of oil reclamation are manifold: reducing the cost of lubrication is the least of these. If we could check the increased mileage due to the better lubrication that accumulated between overhaul periods, we probably would find a 30-per-cent reduction in engine-recondition cost during the life of the vehicle. The better power available would also have a direct bearing on repair costs in clutch and transmission units."

Direct Oil-Cost Economy

A greater availability of answers to the second question, dealing with direct oil-cost economy, exists. The evidence is conclusive that, given a sufficient quantity of oil drainage for a particular size of reclaimer, enough will be saved in direct oil costs to warrant the purchase of reclaiming equipment. On this phase the author continued as follows:

I shall quote from only a few experiences of fleet managements, but these cover a wide area and are representative of the different types of reclaimers in use among fleets. That in these examples the oil-reclamation costs, when depreciation and interest are added to the direct costs such as labor, materials and power, all work out to be about 12 cents per gal., may seem a strange coincidence. I can account for this only in one way, that all are from large-scale operators whose fleets provide considerable oil drainage, that they chose the right size of reclaiming equipment for their operation and that, under such circumstances, it would be stranger if their costs did not parallel one another closely.

The Rieck-McJunkin Dairy Co., of Pittsburgh, re-refines 6000 gal. of oil per year at a cost of 12 cents per gal. This cost includes labor, material, power, interest on money invested and 20-per-cent depreciation on the machine. After one year's operation this company's figures disclosed that the "re-refiner" had returned 275 per cent on the money invested. The garage superintendent prefers the term re-refine to the term reclaim, and so do many others. The preference for re-refine is based on the belief that the very idea of reclaiming something carries a derogatory connotation.

The West Ridge Transportation Co., of Girard, Pa., re-refined 1200 gal. in five months at a total cost of 12 5/6 cents per gal. The overhead cost was 5½ cents per gal. This included an allowance for maintenance, interest on investment and depreciation at the rate of 10 per cent. The direct operating cost was 7 1/3 cents per gal. On the 60-cent oil this company was using a saving of $571.20 in the first five months of operation, was attained by using a machine costing slightly more than $800.

A Mid-Western railroad saved $1,444.88 after 17 months of operation, after wiping out an expense of $3,219.82, which represented the cost of reclaiming and the cost of reclaimer and installation. This fleet reclaimed 10,366 gal. of oil in the 17-month period at an average direct cost of 8.4 cents per gal. The savings were based on oil at 45 cents per gal.

For the month of January, 1932, a Kentucky motorcoach fleet reclaimed 1195 gal. of oil at a total cost of 12.531 cents per gal., thus saving $304.35 on 38-cent-per-gal. oil. On this basis the company figures it will save

$3,652.20 in one year, which will represent a return of 146.1 per cent on a reclaimer investment of $2,500.

In three years a large West Coast operation reclaimed 55,972 gal. of oil at a direct cost of 6½ cents per gal. On 35-cent-per-gal. oil this means a saving of $15,952.02 in a three-year period. Although I did not ascertain how much this company invested in its reclaiming outfit, I do know the brand of reclaimer used and that it could not have cost more than $1,500. This would leave an over-all saving, after wiping out the investment and the cost of reclamation, of more than $14,000.

While the examples I have cited maintain an average per-gallon reclaiming cost of around 12 cents per gal., the savings in individual cases tend to vary because of such factors as volume of drainage available for reclamation, cost of electric current in different localities and the percentage of drainage recovered. So we find one manufacturer of reclaiming equipment explaining that direct costs alone will vary from 5 cents per gal. for large reclaiming units with low electric-power costs, to 12 cents per gal. for small units with high electric-power costs. Another manufacturer says: "We, of course, have some costs both lower and higher, but a figure of 7¼ to 7½ cents per gal. direct operating cost is very close to a mathematical average."

It is perhaps safe to say that total reclamation cost, including all overhead and direct-cost items, will fluctuate from 10 to 18 cents per gal., depending upon the variable elements.

When Oil Reclamation Is Profitable

In approaching the third question, I had hoped to be able to procure a minimum figure on which all reclaimer manufacturers would agree. But apparently no possibility of agreement exists, because the list prices of reclaimers range from $290 up to $2,250 and beyond, and these prices naturally influence a manufacturer's recommendations for profitable investment. Moreover, the price a fleet operator is paying for new oil is another important factor which further complicates the issue. Therefore the variation in the recommendations of what constitutes an attractive investment need not be surprising. All of the manufacturers based their minimum recommendations on available gallons of drainage; and properly so, because this, and not the number of vehicles, is the common denominator.

For these reasons recommendations were: (*a*) a minimum crankcase drainage of 31½ gal. per month; (*b*) 32 gal. per month; (*c*) 75 gal. per month; (*d*) 250 gal. per month and (*e*), made by a manufacturer who omitted to mention his list price, who stated that "operators having less than 150 gal. of oil per week to process will hardly make savings to warrant the use of a reclaimer." But previous evidence in this paper disputes this contention.

Accurate Records Essential

I think I am correct in saying that many operators of fleets do not keep accurate oil-drainage figures. In considering the purchase of a reclaimer, an estimate of drainage can be made, but it might prove to be expensively erratic, because an estimate reached either through the number of units in service or the number of miles operated is not dependable. We must remember that such factors as grade or viscosity of oil used, operating temperatures, maintenance methods, periods of oil change, mechanical conditions of an engine and so on, have a direct bearing on the crankcase drainage that will be returned from a given quantity of new oil used. If drainage for a given period is accurately computed, it becomes an easy matter, since the reclaimer manufacturer can then provide the direct cost per reclaimed gallon to determine the amount of capital investment that will assure a profitable installation.

In conclusion, my inquiries among fleet operators disclose that further economies in direct oil cost by the use of reclaimers are possible if operators will discard certain notions regarding oil. The notion is prevalent that color has something to do with lubricating ability of an oil. Another is the notion that oil must contain no gasoline dilution when it is poured into a crankcase. Present-day reclaimers cater to these notions; consequently, the cost of reclamation is higher than it would be if only practical requirements were considered. This is proved by a large-scale operator in the city of Washington, who saves 1 cent on each gallon by letting the "black color", as he puts it, stay in. "To clear the oil up is useless", he wrote, "because it just looks nice, that's all. It doesn't improve the oil in any way other than to take the color out and clear it up. I don't see any use, unless you want to sell reclaimed oil, to take the carbon color out or the black color."

The foregoing complaint is precisely that of another fleet operator who attacks the dilution notion. "There seems to be an attempt", he states, "to reclaim oil so that it can be resold on so-called specifications, including the absence of dilution. There is no point in reclaiming out all dilution, knowing as we do that perhaps 5 to 10-per-cent dilution, depending upon the operation, will be put in again in a very short time."

This operator determined by tests that maximum dilution in his vehicles occurred between 200 and 400 miles after the crankcase was drained. Thus the experiences of these operators seem to hold out some possibility, not only for even cheaper reclamation, but for cheaper reclaimers.

Other Ideas on Reclamation

R. A. L. Bogan[1] presented another Transportation Meeting paper which he stated is in nowise a scientific analysis of procedure or method but is, instead, designed to give some insight as to the value of oil reclamation to the motorcoach or truck fleet operator. The figures he quoted are taken from his company's records of operation, which includes a network of operating companies from Coast to Coast and from Toronto to Mexico.

Mr. Bogan said that in the infant days of motorcoach operation one of the problems of the maintenance end of the business was the disposal of used lubricating oil. A first use that was attempted for oil drainage was as a fuel for furnaces in garages. In this use the oil was not only unsatisfactory but also was uneconomical and required excessive transportation to keep the required supply in the furnaces. His company began about five years ago to consider seriously the value of the oil that was being thrown away after being taken from the engines. In those days, oil was being drained at 1000-mile intervals.

When it is considered, Mr. Bogan stated, that oil can be reclaimed at an approximate cost of one-third to one-half the cost of new oil and that the purchases of his company in the last year amounted to more than 500,000 gal. of oil at a cost of about 30 cents per gal., average, it is evident that the loss would be terrific if the oil were not reclaimed. He stated also that oil can be reclaimed profitably to the operator when about 10 gal. of used oil can be concentrated at one garage point each day without transportation costs.

The oil reclaimers used in the system controlled by Mr. Bogan's company are located at strategic points, such as Boston, Syracuse, Pittsburgh, Cleveland, Atlanta, Detroit, Chicago, St. Louis, San Antonio, Los Angeles, San Francisco and Portland. Most of the reclaimers are of 50-gal.-per-day capacity. Crankcases are drained at these locations only, except for a few isolated points. In the latter cases, used oil is shipped to a reclaiming point, provided the transportation cost does not prohibit it.

Between 25 and 35 per cent of the original purchases of oil are available for reclaiming. The remainder is burned up, evaporated or otherwise lost or destroyed during use. Between 80 and 85 per cent of the oil available for reclaiming is actually saved, and this oil is as pure and clean as, in many instances cleaner than, the original. Sludge is removed by filtering and cleansing, and the light ends are removed by distillation. Each batch is closely analyzed to make certain that the viscosity and other essentials are at least the equivalent of, and perhaps better than, the original oil. It is a fact, therefore, that the oil available for reclaiming has lost none of its quality or value except on account of dirt, carbon and dilution.

Cost of Used-Oil Reclamation

The actual cost of reclaiming is approximately 9 cents per gal. Adding 5 cents per gal. for depreciation and repairs of the reclaiming machine, the total cost is about 14 cents per gal. New-oil costs are approximately 30 cents, and thus a saving of about 16 cents per gal. of reclaimed oil is effected.

Approximately 125,000 gal. were reclaimed last year at a net saving of about $17,500. Oil is drained at 3750-mile intervals. The cost of the reclaiming machines varies with capacity. Prices are as low as $400 to as high as $5,000. A good 50-gal. machine such as is used by the company costs about $1,500, which includes all necessary reclaiming equipment. At the rate of depreciation used, these machines are written off in from three to five years.

With modern drainage methods, the oil flows by gravity to used-oil tanks, is pumped to the reclaiming machine and after reclamation is pumped to clean-oil tanks. No handling by employes is necessary, and thus the keeping of garages clean and the offensive menace of oil standing in barrels is avoided. To throw away used oil that is obtainable in any substantial quantity from drainings, Mr. Bogan concluded, is synonymous with killing a goose that lays golden eggs.

EDUCATION OF DRIVERS

According to Van W. Dennis, of the Pacific Telephone & Telegraph Co., of Sacramento, Calif., who delivered a paper at a recent Northern California Section meeting, all of the Pacific Coast fleet operators are following up the education of drivers in some form or another, as they all realize that, without their assistance and cooperation, keeping costs at the minimum is a problem. Some operators handle this problem through schools; others through the inspectors or supervisors.

Careless drivers cause accidents, and efforts are being made to educate drivers in safe driving practices. If this cannot be done, drivers are placed on other work or discharged. Some operators pay a bonus to drivers who do not have an accident for certain periods; others award a medal or badge. One problem originates when a man employed for other work is called upon to drive a vehicle. He is usually more concerned with his regular work than he is with driving, especially when he is moving from one job to another. Each particular fleet operator must survey his own operating conditions and apply the system which appears to secure the best results and eliminates the accidents.

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[1]Vice-president, The Greyhound Corp., Chicago.

PHILADELPHIA STILL LEADING
"GET-YOUR-MAN" PROCESSION

AS THE JOURNAL goes to press, our Philadelphia Section is still holding its own with 44.3 per cent of its quota obtained in new members of the Society. Indiana and Baltimore are hot on the trail, however, and with the hearty cooperation sustained by all three of these Sections from their local membership the contest is assuming mighty interesting proportions. For the present, hats of the Society are off to Philadelphia Section!

Our Canadian Section is in fourth place this month, having given way to Baltimore; with Southern California following in fifth. Detroit, in seventh place, is close on the heels of Metropolitan in the sixth. Will there be a tie? A noticeable advance has been made by Pittsburgh with a jump from 13th to 9th place. With these evidences of continued effort by the Sections, it is now impossible to forecast the final outcome.

SECTION STANDING
(Expressed in Percentage of Quota)

Philadelphia	44.3
Indiana	38.0
Baltimore	32.8
Canadian	31.0
Southern California	28.6
Northwest	27.0
Metropolitan	21.0
Detroit	19.9
Chicago	18.7
Pittsburgh	18.6
Kansas City	16.6
Washington	14.0
Cleveland	12.3
Syracuse	12.1
Buffalo	10.5
St. Louis	9.7
Northern California	9.0
Dayton	8.1
New England	7.8
Milwaukee	7.1
Wichita	5.9
Oregon	0.0

John F. Hardecker, of Philadelphia, is still in the lead for individual awards, and R. N. DuBois, of Detroit, H. M. Jacklin, of Indiana, and C. C. Mathis, of Pittsburgh, are forging ahead in second place. With the end of the contest looming on the horizon, the sponsors are very active in an endeavor to have their applicants qualify; this is portentous of unexpected developments in the standing of individual awards. The February issue will throw more light on this matter.

INDIVIDUAL STANDING
(For Individual Awards)

First Place
John F. Hardecker

Tied for Second Place
R. N. DuBois — H. M. Jacklin
C. C. Mathis

Third Place
L. M. Porter

Tied for Fourth Place
A. Gelpke — C. H. Jacobsen
F. K. Glynn — L. R. Joslin

Tied for Fifth Place
George B. Allen — G. O. Pooley
R. N. Janeway — C. C. Stewart
Reese Lloyd — R. R. Teetor
L. V. Newton — O. M. Thornton
John G. Holmstrom

NEWS OF THE SECTIONS

Detroit Section Stages Two Meetings

A FIELD day at Selfridge Field, Mount Clemens, Mich., caused approximately 400 members and guests of the Detroit Section to assemble on the morning of Dec. 3 as guests of the First Pursuit Group of the Army Air Corps and its commanding officer, Major George H. Brett. With Air Corps officers as guides, groups of the visitors were shown over the recently rebuilt station, now the most modern Army air station in the Country.

The review, delayed for an hour because of fog, was held at 11:15 a. m. and was followed by a demonstration of the unbelievably precise formation flying for which the First Pursuit Group is famous. Using two-way radio communication between his plane and those of his squadron commanders, Major Brett led the group through 45 min. of tactical maneuvers that ended with the spectacular "rat race" in which the entire group played follow-the-leader as they dove in and out of the clouds in single file.

A Talk on Military Aviation

At luncheon in the Officers Club, 145 S.A.E. members were introduced to the ranking officers of the post and heard Major Brett give a short talk on Military Aviation. After describing briefly the organization of Selfridge Field, the speaker discussed the present status of Air Corps equipment. When questioned by Section Chairman Rippingille, some of the requirements of the pursuit planes of the future were enumerated by Major Brett. He pointed out that pursuit planes must be 50 per cent faster than the fastest bombers to enable them to overtake and attack in time. With bombers capable of a speed of 200 m.p.h., pursuit speeds in excess of 300 m.p.h. are required.

Major Brett, replying to Carl Fritsche, explained the reasons for the development of the famous "interceptor" fighters of Great Britain. He closed his address with a plea for public recognition of the hazards of duty of the Air Corps flying personnel, backing his statements with statistics of flying fatalities for the last three years.

Following luncheon, 110 of the guests were taken aloft in aircraft furnished through the courtesy of the Trans-American Airlines, the Continental Motors Corp. and Louis C. Huck; the craft used being, respectively, a 12-passenger tri-motor Trans-American Airliner, a 4-passenger Continental-engine-powered Waco cabin plane and a 3-passenger Pitcairn biplane. Preference in the flights was given those who had not previously flown; but, at the luncheon, Toastmaster Ralph Dubois made the astounding discovery that not more than three of that group of aviation enthusiasts had been aloft before.

Dec. 5 Meeting Replete with Data

Four papers were presented by three of the Section's Activities at the Dec. 5 meeting; namely, the Passenger-Car, Production and Body Activities. G. B. Allen presented R. E. S. Geare, who gave a dissertation on Automotive V-Shaped Fan-Belts. V. P. Rumely introduced W. E. Sanders, whose paper was entitled Researches on Steels and Forgings. J. W. Votypka and C. O. Richards sponsored John Marshall's paper on Synthetic Finishes, as well as the one by Newton N. Manning on Readjustment in Its Relation to the Automotive Industry.

Aeronautic, Passenger-Car Production and Body Activities Sponsor Valuable Papers

Mr. Geare's paper suggested a standardization of fan-belt sizes which cover present requirements of all types of automobiles, buses and trucks. He stated that it is proposed to use five distinct cross-sections of V-belts and discussed these in detail. The special features treated were flexibility, sheave diameters and groove angles, non-stretch characteristics and general design.

The fan belt is being increasingly used on the automobile, said Mr. Geare. Its utility is becoming more and more apparent when it is considered that this one belt takes care of the fan, water-pump and generator requirements. Every designer well knows that standard industrial V-belts cannot be used in the automobile drive of today and that belts of special cross-sections are required to obtain necessary strength and a sufficient flexibility over minimum-diameter sheaves. But to determine the exact cross-section which is best suited for a given requirement constitutes a problem that should be solved by the V-belt engineer.

Researches on Steels and Forgings

Mr. Sanders' paper dealt with the improved machinability and durability obtained by the greater working or compressing of steel in the process of forging, and also the various steel characteristics affecting the development of greater density in forgings. The author stated that the result of this working or compressing is referred to as density, but in the sense of greater compression rather than specific gravity.

The main points of the paper were considered in detail, the subjects being the theory of porosity in deep-etched forgings, forging practice and its relation to density, the relation of McQuaid-Ehu grain size in steel to density in forgings, the response of forgings to annealing treatments, and improved machinability and improved durability resulting from denser forgings.

Mr. Sanders' conclusions were that, regardless of analysis, the same beneficial results were obtained with all types of steel used. It has been shown that it is possible to produce denser forgings, in which slipping and tearing of the fibers are eliminated, by employing a steel of a specified grain size, accurate forging temperatures and specially designed dies for controlling the flash to assure greater compression of the forging.

By employing the foregoing procedure, Mr. Sanders said, forgings are produced that have a more uniform anneal, thereby effecting better machinability; that is, greater feeds and speeds and longer tool life. These denser forgings also have proved highly responsive to the hardening treatment, resulting in uniform distortion, and dynamometer tests run for durability have shown that the life of gears has been increased more than 300 per cent, with marked decrease in pitting and granulations, the maintenance of smoother surfaces and quieter operation.

Written discussion of this paper was presented by E. J. Abbott, research physicist of the University of Michigan; and by S. D. Williams, of the Timken Steel & Tube Co.

Automotive Industry Readjustment

After briefly reviewing facts connected with present economic conditions, Mr. Manning referred to some of the ills which should and must have earliest consideration. He analyzed the subjects of volume of production versus absorption, restoration of buying power, mass production, provision for additional demands by overtime or increase in regular working hours, and adequate research in its effect on car appearance, weight reduction, riding qualities, chassis frame and mounting.

Maintenance of employment, in Mr. Manning's opinion, is the most important factor connected with business recovery. In the development of our present industrial system, the engineer has been forced to concentrate on engineering and production problems in their application to machines. The operations of a future successful social order will demand the same degree of concentration in effecting the stabilization and maintenance of a uniform employment system.

Synthetic Finishes Defined and Analyzed

Mr. Marshall stated that, as a result of the introduction of a gradually increasing number of synthetic resins of various types, the term "synthetic finishes" has developed among the users and suppliers of paint products. The term may include those finishing materials having vehicles composed entirely of some form of synthetic material and also finishes in which the vehicles are varnishes containing some synthetic resin. These two definitions may lead to radically different types of final product.

Of the resins which have entered into the practical commercial finishes, said Mr. Marshall, the following three types can be considered representative: (*a*) the amberols, or resin-modified phenolic resins, (*b*) the oil-soluble straight phenolic resins, and (*c*) the glyceryl phthalate resins, or glyptals. The evaluation of a finishing material customarily depends on several major points, the principal criteria probably being drying speed; inertness to the sun and weather, or durability; and ability to withstand distortion, or flexibility. The minor criteria will be ability to withstand marring, or hardness; gloss retention on exposure; resistance to erosion; adhesion; and moisture resistance.

Mr. Marshall contrasted the properties of the three synthetic-resin groups in the ultimate-binder compositions with the properties of resin as a measuring stick, in an effort to find the place in the finishing industry where each of these three resin groups fits best, as well as to analyze with the aid of charts the technicalities involved in his subject.

BUFFALO CONSIDERS ENGINE-COOLING PROBLEM

Two speakers presented papers on engine cooling and temperature regulation before a gathering of 75 members and guests of the Buffalo Section on November 16, at the Statler Hotel. The first speaker was Lawrence P. Saunders, assistant chief engineer of the Harrison Radiator Corp., whose topic was Oil-Temperature Regulation and Engine Cooling. The topic of the second speaker, Elwood T. Larkin, chief engi-

neer of the Sterling Engine Co., was Problems of Marine-Engine Cooling.

Following the presentation of the papers, they were discussed by R. T. Howe, experimental engineer of the Pierce-Arrow Motor Car Co.; H. J. Helfrich, truck experimental engineer of the Pierce-Arrow company; G. V. Ronan and J. H. Taylor.

The Section elected Mr. Saunders to represent it on the Sections Committee of the Society during 1933.

GEARS, THEIR LUBRICATION CONSIDERED AT SEATTLE

Gear design, including recent improvements in spiral-bevel and worm types, and the lubrication of involute gears were discussed at the Dec. 2 meeting of the Northwest Section. The respective speakers were Thomas J. Bannan, vice-president and manager of the Western Gear Works, of Seattle, and George A. Zamboni, factory representative of the Sinclair Refining Co.

Thirty-eight members and guests were present at the meeting, which was held at the Bergonian Hotel in Seattle. Section Chairman C. C. Finn, who presided, announced that the January meeting will be devoted to steels and steel treating and the February meeting, to steel spraying, welding and cutting. Following the presentation of the two addresses and the discussion on them, Mr. Zamboni displayed motion pictures of the oil-refining process.

Mr. Bannan's talk on gears was in the nature of a series of answers to practical questions that his company had been asked regarding gears. Referring to the wide range of gear sizes, he said that his company now has the job of making gears for the 650-ton doors of the new airship hangar at Sunnydale, Calif. The importance of designing teeth for each type of service was emphasized, and the speaker stated that a pressure angle of 14½ deg. is the most popular at present and the design must be such that constant tooth strength will be in action. Several types of gears, representing great improvements over the bevel gears first introduced by Packard 20 years ago, were exhibited. Speaking of worm gears, he said that wear, when once started, is difficult to arrest.

Considerable discussion followed regarding the use of worm gears in trucks, John M. Holmstrom, of the Kenworth Motor Truck Corp., leading in this. Difficulty of lubrication and overloading seemed to be the greatest drawback, he said, and accounted for most failures. The latest types of worms, however, are far ahead of the old ones and give excellent satisfaction. Mr. Bannan said that automotive work is much more suitable for the use of worm gearing than are ordinary industrial requirements because of the fast ratios. The deep worm teeth and meshing of four or five teeth at once were pointed out as advantages.

Mr. Zamboni confined his talk largely to lubrication of involute gears and the general laws of friction. The important part played by the lubrication engineer in cooperating with the machinery manufacturer and the metallurgist in providing lubricants to meet advances and high-speed requirements helped greatly in the progress made by our machine age, he said. To lubricate gears perfectly is harder to do than general lubrication, providing fluid friction between the metal parts being only part of the problem. The film must first be formed and then maintained. Gear contact is just a line contact. Rolling motion and angular sliding motion add to the difficulties. Profile gear teeth, no matter how carefully made, first require the grease to form a high antifriction surface; then the next step is to lubricate it constantly. Composition of gear lubricants was next discussed, the merits of various types being explained. Use of light abrasives in lubricants was not recommended.

FUEL AND ENGINE TESTING FEATURED AT MILWAUKEE MEETING

More than 300 members and guests attended the Milwaukee Section meeting held Dec. 9 at the factory of the Le Roi Co. at West Allis, Wis. W. M. Holaday, of the Standard Oil Co. (Indiana), chose as his subject Service and Laboratory Fuel Testing. K. T. Winslow, of the Waukesha Motor Co., also presented a paper entitled The C.F.R. Unit and How to Work It.

Mr. Holaday said in part that, during the last year, the Cooperative Fuel-Research Detonation Subcommittee, by cooperative testing, established a road-test method for evaluating the antiknock value of fuels in commercial cars and modified the C.F.R. knock-testing method to assure that knock ratings obtained on all motor fuels be as nearly as possible representative of average, normal car performance. This work is of vital importance to the engine builder, the oil refiner and the consumer of the products produced by these two industries.

Continuing, Mr. Holaday said that the automotive industry has carried on research work on combustion-chamber design, engine cooling and the like to develop engines to give maximum power on the present-day fuels with the minimum amount of detonation. At the same time the oil industry, through extensive research work, was developing new methods and means whereby fuels of better antiknock value could be produced.

A lack of complete cooperation between these two industries and an apparent misunderstanding of the problems encountered by each hindered their mutual progress and satisfactory development of their products. But in the last few years, said Mr. Winslow, these industries have united in efforts to solve the separate problems of each through the Cooperative Fuel-Research Committee. The progress made by the Detonation Subcommittee was then stated at length, and the development of a road-test procedure was described.

Other features of Mr. Holaday's paper included a summary of the data obtained at Uniontown, Pa., laboratory correlation at Waukesha, Wis., the essential features of the C.F.R. road-test method for conducting antiknock tests, and modifications in the C.F.R. apparatus and procedure for conducting antiknock tests. In conclusion, the speaker said that he felt that the petroleum industry can and will furnish the automotive industry with gasoline of a higher antiknock value and better antiknock stability.

BALTIMORE HEARS ABOUT LUBRICATION AND PISTON RINGS

One hundred members and guests of the Baltimore Section listened to a paper on crankcase oils and lubrication and another on the development and use of piston-rings for high-speed engines, then bombarded the speakers with questions for 1½ hr. at the Dec. 15 meeting of the Section at the Hotel Emerson. Chairman White finally had to stop the discussion for adiournment of the meeting at a late hour.

The paper on piston-rings was delivered by Jack Holls, engineer of the American Hammered Piston Ring Co., of Baltimore, who covered all phases of the subject. The paper on crankcase oils was presented by J. R. Hill, manager of the field service division of the Standard Oil Development Co., of Elizabeth, N. J., who spoke on the lubrication considerations involved in engine operation and related directly to piston-rings. He devoted considerable attention to combatting the assertions that an oil which has been used for several hundred miles in a car is as good for the engine as when it is fresh from the refinery.

Degradation occurs, said Mr. Hill, from thermal decomposition, or cracking, and from oxidation. Results of these chemical actions are the formation of a complex mixture or compound, partly acid, that form sticky metal soaps which collect in piston-ring grooves and oil lines, causing trouble and sometimes serious damage. Water from vapor condensation in the engine also may exist in intimate contact with the oil, forming a pasty emulsion. A typical analysis shows a composition of: water, 28 per cent; oil, 62.5 per cent; and oxidized material, 9.5 per cent. The oxidized material forms sludge containing carbon, oxygen, ash, hydrogen and sulphur.

Contaminating materials also enter the oil from engine wear and from the air entering the engine. Useful life of the engine undoubtedly is prolonged, according to Mr. Hill, by the use of the air-cleaner, the oil filter, the oil cooler and the crankcase ventilator, provided these are properly maintained.

In conclusion, the speaker asserted that regular changing of oil at intervals based on service-station recommendations, is the best procedure and cheapest in the long run.

LOW-PRESSURE SUPER-BALLOON TIRES DISCUSSED AT CLEVELAND

Two papers on the new super-balloon tires were presented at the Dec. 12 meeting of the Cleveland Section, which was honored by the presence of President Scaife and Presidental-Nominee Dickinson. In recognition of the fact that Mr. Scaife is the first President of the Society elected from the Cleveland Section and of the appreciation of the work he has done for the Society, the Section presented him with a handsome overnight case. Chairman Kemble welcomed the members of the Council who were present, and Dr. Dickinson gave a short inspirational address of interest to the members of the Section.

At a brief business session Hoy Stevens was elected to represent the Section next year on the Sections Committee of the Society, and a representative and two alternates were elected to the National Nominating Committee.

A total of 140 members and guests attended the technical session, which followed a dinner in the Cleveland Club at which 87 were present and orchestral entertainment was provided.

Pros and Cons of Super-Balloons

Super-Balloon Tires, in Retrospect and Prospect was the title of the first paper, by B. J. Lemon, of the U. S. Rubber Co. The author stated that the experience of the last year clearly indicates that a mistake was made in trying to introduce the larger tires as field replacement and also in offering for substitution such a large oversize as a 9.00-in. tire for cars in the light-weight class. Difficulties that arose from these mistakes were cited, and Mr. Lemon said that the super-balloon accentuates the need for more scientific study of the relation of tread design to car design, the requirement of improved car design, and the maintaining of cars more nearly to such specifications as axle camber, caster and wheel toe-in. In conclusion, he mentioned cars that will be equipped with super-balloon tires this year, as already an-

nounced, and said that many other 1933 models will have them as optional equipment.

Tore Franzen, of the Chrysler Corp., gave some notes on the application of low-pressure tires to light passenger-cars and illustrated them with slides of test machines and charts of car oscillations. He discussed tread wear, inflation, safety and the effect of the tires on front-end phenomena. The consensus of opinion, he concluded, is that the new tires give increased riding comfort and reduction of body noise and rattles; that many new cars are designed so that the large tires will harmonize with the lines of the fenders and other sheet-metal work, and that the public will be the final judge as to the relative advantages and disadvantages of the low-pressure tires.

Prominent part in the discussion on the papers was taken by K. D. Smith, of Goodrich; J. M. Crawford, of Chevrolet; B. Darrow, of Goodyear; and H. W. Kranz, of the Cleveland Wheel Co.

PIERCE-ARROW V-12 ENGINE DESCRIBED TO BUFFALO SECTION

Increased interest in the Buffalo Section's activities was indicated by the fact that more than 100 members and guests attended the Dec. 14 meeting at the Hotel Statler. Those attending declared the meeting to have been most interesting and instructive. It was conducted informally by Fred A. Cornell, as Acting Chairman, since M. A. Thorne, Chairman of the Section, was one of the speakers.

In opening the program, Karl M. Wise, director of engineering for the Pierce-Arrow Motor Car Co., pointed out the reasons for the design of the company's V-12 engine, stressed the need for higher-powered engines for present-day motor-cars, mentioned the desirability of smaller cylinders with which higher compression is possible with freedom from detonation, and discussed several other factors which point to the need for a multi-cylinder engine. In the design of a 12-cylinder engine, Mr. Wise pointed out the limitations of an end-to-end arrangement of cylinders such as the prohibitive length and the introduction of manufacturing difficulties on unit parts such as the crankcase, cylinder block, cylinder heads and camshaft. He also mentioned the complications involved with crankshaft torsional periods and all other factors that point to the desirability of a V-type engine. Further, he gave the reasons for various design details, such as an 80-deg. angle between cylinder banks to give the best condition with regard to vibration and to permit the valve gearing to work from one camshaft, as well as an L-head arrangement of valves to give the greatest simplicity and to secure maximum quietness.

Component Parts of the Engine

M. A. Thorne, chief experimental engineer of the Pierce-Arrow company, conducted an intimate discussion of the V-12 engine's component parts such as the oil-temperature regulator, hydraulic valve-lifters, accessory drive, camshaft, oil-pump and lubrication system and front-end chain drive, explaining also the details of construction of cylinder-blocks, cylinder heads and crankcase. He emphasized the importance of maximum cooling in the region directly around the valves. Some details of the procedure in selecting the fitting pistons and connecting-rods were explained. He described the advantages of the particular arrangement of the rubber-biscuit type of engine mountings and their capability in reducing transverse, vertical and pitching engine movements, coupled with their great efficiency in damping out transmitted vibrations. A very complete and pertinent selection of lantern slides were used by Mr. Thorne to illustrate cutaway units of the engine.

Carburetion and Manifolding System

Russell T. Howe, engine-development engineer of the company, gave a very interesting paper on the carburetion and manifolding system used on the new V-12 engine. He pointed out the advantages and reasons for choosing the downdraft system of carburetion and manifolding, such as the adaptability of the downdraft system to V-type engine construction and the improved distribution made possible by the direct and properly streamlined intake runners obtainable with this design, which results in greater power and low-speed torque as compared with the old-type updraft system.

Other main points were accessibility of carbureters, ease of synchronizing the two carbureters which are used and the simplicity in hook-up of automatic chokes used in conjunction with the downdraft carbureters. Mr. Howe discussed in detail the operation and pertinent features of the carbureters, manifolds, thermostatic mixture heat, crankcase-ventilator system and automatic-choke arrangement.

Under the direction of Louis R. Jones, assistant chassis engineer of the Pierce-Arrow company, interesting motion pictures were presented showing scenes from an endurance run with this engine on Salduro Dry Lake, Utah, in which a Pierce-Arrow car equipped with the V-12 engine and piloted by Ab Jenkins covered 2710 miles in 24 hr. at an average speed of 112.91 m.p.h.

At the close of the meeting considerable attention was given by the members to a display of various parts of the V-12 engine.

SCAIFE TELLS SYRACUSANS ABOUT BUS AND TRUCK TRANSPORTATION

The gradual application of such factors as safety, comfort and advanced mechanical features in motorcoaches and motor-trucks was reviewed by President Scaife, of the Society, in a paper he presented at a meeting on Dec. 5 at the Onondaga Hotel in Syracuse. This was a meeting of the Technology Club of Syracuse, with which the Syracuse Section of the Society recently became affiliated. An audience of 160 members of the Section, the club and other affiliated societies listened attentively to the presentation of the subject by Mr. Scaife.

CRANE GIVES MET SECTION HIS VIEWS ON ENGINES

Past-President Henry M. Crane, of the General Motors Corp., supplemented the talk he gave on improved automobile design at the November meeting of the Philadelphia Section with an address on engines before the Metropolitan Section on Dec. 8. At the New York meeting in the Hotel New Yorker, the speaker reviewed at length the changes in engine design that have been forced by the public demand for higher car speed and at the conclusion of the talk was subjected to a barrage of questions from his keenly interested auditors who desired Mr. Crane's valued opinion on a variety of ideas with regard to engines.

Mr. Crane's remarks at both the Philadelphia and New York meetings are embodied in a paper and discussion printed in this issue of the S.A.E. JOURNAL.

The Metropolitan Section meeting had a turnout of 81 at the members' dinner and 175 to hear the veteran engine and car engineer's constructive analysis of engine types as related to present requirements and to possible future streamline cars.

LEGISLATION AND TAXATION ANALYZED AT PITTSBURGH SECTION MEETING

A dinner held on Dec. 6 in the Fort Pitt Hotel attracted 63 members and guests of the Pittsburgh Section, and 75 attended the technical session that followed.

In presenting his paper on Some Phases of Motor-Vehicle Legislation, A. J. Scaife, President of the Society, gave an interesting discussion of the true background of our motor-transportation situation and its relation to the use of highways in competition with other forms of transportation. He included lantern slides presenting data accumulated by the National Automobile Chamber of Commerce and the Bureau of Public Roads.

The high lights presented by President Scaife were that 26 per cent of our trucks are owned by farmers and more than 2,000,000 trucks are owned by individuals. Conversely, only 1 per cent of the total vehicles owned are trucks engaged in interstate commerce. Actual studies show that the total tonnage carried by trucks is infinitesimal compared with that handled by the railroads, and that railroad freight traffic tends to follow closely the value of the products of industry.

President Scaife presented data to show that the actual cost of constructing roads to take care of the largest trucks and payloads that we have today is inconsiderable in relation to the cost of the highway for personal cars. He also submitted information to prove that truck taxes are proportionate to road wear, although he admitted that some inequalities exist in the amount of tax—the general average for all States—charged against vehicles of the different sizes.

Motor-Vehicle Tax Situation

The second speaker of the evening was Virgil Thomas, a prominent Pittsburgh attorney, who has made considerable study of the motor-vehicle tax situation as it applies to Pennsylvania. He suggested that much of the restrictive legislation, both physical and taxing, has been instituted through a misunderstanding of the true situation on the part of the public, politicians and newspapers, and two examples of gross misrepresentation were given. He outlined concisely the tax structure of the Commonwealth of Pennsylvania as regards general tax funds, motor-vehicle special funds, the various political subdivisions including counties, boroughs and townships, and the special taxing privileges of Philadelphia and Pittsburgh. By statements derived from authentic State and national publications, he proved the lack of necessity for increased taxes on motor-vehicles.

In Mr. Thomas's opinion, it is necessary for all interested persons to take steps to preclude the diversion of motor-vehicle tax receipts to the State general funds, as Pennsylvania already has constructed a magnificient system of arterial highways on which bonds have been issued directly against motor-vehicle funds to be received from license fees, the gasoline tax and the like. Maintenance of these highways must not be neglected, he said. Unless a halt is called very shortly, taxing authorities are about to kill the goose that lays golden eggs. Automobile construction and operation have been responsible in large part for the prosperity of the Country in recent years, and restrictive legislation will be harmful.

Interesting side-lights on the situation were

brought out in the discussion following the presentation of the papers.

AUTOGIRO EXPLAINED TO NEW ENGLANDERS

The Autogiro was the subject of the paper presented by Heraclio Alfaro at the Dec. 14 meeting of the New England Section, held in the auditorium of the Walker Memorial building of the Massachusetts Institute of Technology at Cambridge, Mass. The author reviewed the development of this machine.

Despite the severe weather, 20 members and guests attended the dinner preceding the technical session and 60 were present to listen to the presentation of the paper. Additional interest was created by the showing of the motion picture called Wings of Tomorrow.

The M.I.T. Student Branch of the Society meets with the New England Section monthly and has also been holding weekly meetings. At the weekly meetings reports on the European automobile shows, Autogiro progress and the Ford V-type eight-cylinder engine, together with current events, have been studied with good results.

HIGH-COMPRESSION FUEL DESCRIBED AT LOS ANGELES

This subject was presented by David E. Day, chief refinery engineer of the Richfield Oil Co. (California), in a paper delivered at the technical session of the Southern California Section, held Dec. 2 in Los Angeles. A dinner in the cafeteria of the Richfield Building attracted 82 members and guests, and the total registered attendance was 98.

Prominent discussers of Mr. Day's paper were Carl Abell, A. H. Harris, Claude E. Botkin, F. C. Patton, C. E. Emmons, E. Favary and several other members and guests.

In the absence of Chairman C. F. Lienesch, the acting chairman was C. H. Jacobsen. Mr. Lienesch was still confined to a hospital as the result of an injury received in an airplane accident at Wharton, Tex., but was convalescing.

DETROIT SECTION S.A.E. STUDENT CONTEST

The Detroit Section of the Society, to promote its Student Activity, is sponsoring a Gold Medal Competition for the students in the following schools and colleges in the Detroit area:

Educational Institutions	*S.A.E. Faculty-Representatives*
University of Michigan	W. E. Lay
University of Detroit	Peter Altman
Michigan State College	G. W. Hobbs
General Motors Institute	H. A. Huebotter
Detroit Institute of Technology	L. L. Henry
Detroit City College	W. F. Gerhardt
Cass Technical High School	A. D. Althouse
Lawrence Institute of Technology	R. E. Lawrence

Gold medals are to be awarded for the best graduate and the best undergraduate report, paper or thesis involving original thought on a subject of automotive or related interest. [The term "automotive" includes all phases of the Society's activities; that is, Aircraft, Aircraft Engine, Diesel Engine, Motor-Truck, Passenger-Car, Passenger-Car Body, Transportation, Production and Marine.]

The contest will be conducted as follows:

(1) The undergraduate competition will be open to any junior or senior student. The graduate competition will be open to any enrolled graduate student.

(2) Papers by individuals only will be considered. Different individuals may use the same data if the data have been collected by a group of which the individual is a member.

(3) The papers must be submitted to the S.A.E. faculty-representative at each school, as previously listed. Papers must be either typewritten or printed, and are limited to a minimum of 2000 and a maximum of 5000 words.

(4) Two papers of each class are to be selected by each faculty-representative from the papers submitted to him. These papers may or may not be part of regular school requirements.

(5) The papers selected by each faculty-representative must be delivered to the S.A.E. Contest Committee of the Detroit Section on or before May 2, 1933.

(6) The Student Contest Committee of the Detroit Section will choose the winning paper of each grade from papers submitted to it by the school representatives. Papers will be judged from the standpoint of (*a*) originality and vision, (*b*) planning and procedure, (*c*) practicability of ideas represented, (*d*) interpretation of results, and (*e*) style, clarity and neatness. The winners will be notified on or before May 9, 1933.

(7) An abstract of the winning paper of each grade will be read by the author at the regular meeting of the Student Activity to be held May 23, 1933, and the medals will be presented on that date. A list of authors and subjects will be read at that meeting.

(8) The winning papers will be retained by the Detroit Section of the Society, and other papers submitted will be returned to the contestants at the May 23 meeting.

This statement is issued on the authority of E. V. Rippingille, Chairman of the Detroit Section, H. T. Woolson and J. J. Caton, respectively Vice-Chairman and Assistant Vice-Chairman of the Student Activity.

CHICAGO SECTION STUDIES PETROLEUM

The technical session held Dec. 6 by the Chicago Section featured Recent Developments in the Petroleum Industry. The speaker was R. E. Wilson, director of research, Standard Oil Co. (Indiana), who addressed an audience of 75 members and guests. He presented informative data on recently developed processes for cracking gasoline, and also discussed synthetic oil, hydrogenation and the rewaxing of oils. The meeting was held at the Sherman Hotel.

PHILADELPHIANS DEBATE SELECTION OF COMMUNITY TRANSIT EQUIPMENT

Suitability of vehicular equipment of different types of passenger traffic under varied conditions of municipal transportation needs was analyzed in a thorough way at the meeting of the Philadelphia Section on Dec. 14 by Charles O. Guernsey, of the J. G. Brill Co. Prepared discussions on the subject were presented by H. S. Murphy, of the Philadelphia Rapid Transit Co., who dealt with electric cars; S. A. Keihn, of the J. G. Brill Co., who spoke on trackless trolleys; and H. H. Stier, of the P. R. T. Co.; A. H. Kinghorn, and J. R. McCain, of the Aronomink Transportation Co., who spoke about motorbuses. Oral discussion was given by J. C. Thirlwall, of the General Electric Co.; J. H. Wickersham, of the Conestoga Transportation Co., and D. J. Locke, of the United Railways & Electric Co. of Baltimore.

The technical session had an excellent attendance of 190 and followed a members' dinner at which 116 members and guests were present and entertainment was provided.

"TRAMP" ATTACKED AT INDIANA SECTION

The subject of Tires and Wheels as Causes of Tramp was presented at the Dec. 8 meeting of the Indiana Section by Dr. O. E. Kurt, of the U. S. Rubber Co. It was discussed by G. H. Freers, Louis Schwitzer, M. O. Teetor, H. M. Jacklin, P. A. Watson and others, following its presentation.

The dinner, held at the Indianapolis Athletic Club, attracted 45 members and guests, and the registered total attendance was 85. The meeting was reported to have been one of the best held this season.

Definition and Analysis of "Tramp"

Mr. Kurt said in part that "tramp", a particular type of front-end disturbance, is a vertical vibration of the front axle accompanied by a small degree of simultaneous oscillation of the wheel assembly about the knuckle-pin. This vibration in turn sets up disturbance of the body and chassis. The front-axle vibration is caused by the unbalance and variation in rolling radius of the rotating front-wheel assemblies. The theoretical action of these two factors was developed in detail and supported by experimental results.

The foregoing two factors act independently, Mr. Kurt stated. The resultant of the two periodic forces which they set up depends on their phase relationship. The forces due to unbalance are in the same direction as the forces due to variation in rolling radius and enhance their effect when the center of gravity of the rotating assembly is in the region of mimimum rolling radius; they are in the opposite direction and nullify the forces due to variation in rolling radius when the center of gravity is in the region of maximum rolling radius.

The amount of unbalance and variation in rolling radius and the amplitude of the resulting axle vibration necessary to cause tramp varies with different automobiles, according to Mr. Kurt. They can be reduced by increasing the uniformity of tire-wheel assemblies and their effectiveness can be reduced by correct body design.

FUEL PROBLEMS INTEREST WASHINGTON SECTION

Specific gravity and volatility are no longer chief criterions in selecting fuels for automotive use, said H. K. Cummings, of the Bureau of Standards, in an address before the Washington Section on Dec. 21. E. D. Merrill, of the Washington Rapid Transit Co., discussed briefly fuel selection from the operator's viewpoint, and J. R. Hill, of the Standard Oil Development Co., described some of the oil companies' problems that have arisen with the development of knock ratings.

A small but interested group asked numerous questions after the speakers had finished their addresses. Dr. H. C. Dickinson, of the Bureau of Standards; John A. C. Warner, General Manager of the Society; and C. H. Warrington, of the Warrington Motor Co., were among those present. C. S. Bruce acted as Chairman.

PERSONAL NOTES OF MEMBERS

Preble Appointed Pierce-Arrow Division Manager

Important organization and personnel changes announced following consolidation of The White Co. with the Studebaker Corp. and removal of the Pierce-Arrow truck business to Cleveland include the elevation of T. L. Preble to the position of manager of the Pierce-Arrow division of The White Co. He formerly was sales manager of the Pierce-Arrow division of the S.P.A. Truck Corp., of Buffalo, which passed out of existence on Jan. 1. Mr. Preble has been a member of the Society's Transportation and Transportation and Maintenance Committees for the last four years. He contributed a valuable paper on Some Problems of the Motor-Transportation Executive at the Transportation Meeting in November, 1931, which was published in the S.A.E. JOURNAL for December, 1931.

S.A.E. Members Speak on Finance

Two members of the Society were among the speakers who presented papers at a three-day convention of the National Association of Finance Companies, held in New Orleans beginning Dec. 6. John N. Willys, of the Willys-Overland Co. and former United States Ambassador to Poland, spoke on Men, Money, Motors and Business. C. H. Warrington, president of the Warrington Motor Car Co., of the City of Washingtno, spoke on Insurance as It Relates to Installment Financing. Members of the Society will recall the address given by Mr. Willys at the Annual Dinner in New York City last January. Ample time was allotted for discussion of the endeavoring of the association with reference to endeavoring to establish the eligibility of finance-company paper for rediscount with Federal Reserve banks.

Members Address A.S.M.E. Meeting

C. W. Spicer, Treasurer of the Society last year and vice-president of the Spicer Mfg. Corp., is the author of a paper on Carburizing with Butane Gas which was one of more than 50 papers presented at the annual meeting of the American Society of Mechanical Engineers, held in the Engineering Societies Building, New York City, during the week of Dec. 5 to 10. Another paper by a member of the S.A.E. was that by Prof. S. P. Timoshenko, of the University of Michigan, on Working Stresses for Columns and Thin-Walled Structures.

McMullen Joins Tyson Corporation

George C. McMullen, formerly of the Timken Roller Bearing Co., has joined the Tyson Roller Bearing Corp., of Massillon, Ohio, as manager of industrial sales. During his 15 years with the Timken company, Mr. McMullen organized the industrial bearings division and for many years had charge of bearing sales and engineering activities in the territory west of Denver. Prior to joining Timken he was associated in manufacturing and engineering capacities with the Timken-Detroit Axle Co. and the Crane Motor Car Co. He has a wide acquaintance in the general industrial field and the automotive industry and is a graduate in mechanical engineering from Lowell Institute at the Massachusetts Institute of Technology.

CLIFTON C. BIGAREL, formerly head electrician with the Eastern Greyhound Lines, at Salina, N. Y., is now a scholarship student at Buffalo State Teachers College, in Buffalo, taking the one-year course in vocational-teachers' training.

APPLICANTS FOR MEMBERSHIP

The applications for membership received between Nov. 15 and Dec. 15, 1932, are listed below. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

BARNES, LYMAN P., president, Barnes Battery & Ignition Service, *Toronto, Ont., Canada.*

BEDFORD, REGINALD, sales engineer, Benjamin Whittaker, Ltd., *London, W. C. I., England.*

CARR, WILLIAM HENRY, lubrication engineer, Shell Eastern Petroleum Products, Inc., *Charlotte, N. C.*

CORLESS, LEE M., laboratory assistant, Chevrolet Motor Co., *Detroit.*

ELLIS, RAY C., manager, radio department, United Motors Service, *Royal Oak, Mich.*

EVANS, MAX M., assistant chief engineer, General Motors of Canada, Ltd., *Oshawa, Ont., Canada.*

FOLCH, JOSE GALLART, consejero delegado, La Hispaño-Suiza Fabrica de Automobiles S.A., *Barcelona, Spain.*

HELMS, H. RUDOLPH, mechanical engineer, Moltestrasse 12, *Varel Oldenburg, Germany.*

JOHNSEN, WILLIAM HENRY, owner and manager, Technical Chemical Co., *Dallas, Tex.*

LAMB, FRANK H., president, Lamb Tractor Co., *Hoquiam, Wash.*

LAROWE, HAROLD K., assistant purchasing agent, Dairymen's League Cooperative Association, Inc., *New York City.*

McLENNAN, DOUGLAS, traveling representative, Precision Machine & Foundry, Ltd., *Calgary, Alta., Canada.*

NONWEILER, KARL H., technical assistant, Shell Petroleum Corp., *St. Louis.*

ROHLOFF, DEWEY C., automotive engineer, Richfield Oil Co. of California, *Seattle.*

ROPER, VAL J., engineer, Nela Park engineering department, General Electric Co., *Nela Park, Cleveland.*

SMITH, ADAM F., vice-president, R. C. Smith & Son, *Toronto, Ont., Canada.*

SOSSI, LUIGI, special representative to the United States Fiat Automobile Co., *Turin, Italy.*

TYLER, TRACY BROOKS, consulting engineer, 2056 Oakman Boulevard, *Detroit.*

ROBERT B. GALLOWAY has resigned his position of vice-president and chief engineer of the Aeronautical Corp. of America, of Cincinnati, and has not announced his plans for continuing his connection with the aviation industry. After serving since 1916 in various capacities the Curtiss Aeroplane & Motor Co., the Bureau of Aircraft Production, the Packard Motor Car Co., and the Army Air Corps engineering division, Mr. Galloway became associated with C. G. Dietz, one of the organizers of the Aeronautical Corp. of America and, starting in 1928, gathered a personnel, planned the factory layout and had charge of the engineering development of the Areonca airplanes and engines.

LLOYD H. LEONARD, having left his position as engineer with the Edward G. Budd Mfg. Co., of Philadelphia, is now located in Los Angeles. His plans for the future have not been announced.

CHARLES M. MITCHELL has been reappointed to his former position of instructor at the McKinley Trade School, of Wheeling, W. Va. Following his former connection with the school he was located for 15 months in Los Angeles, where he was proprietor of the Golden State Garage.

J. A. PURVIS, formerly technical editor of *Automobile Trade Journal* and more recently managing editor of *Motor World Wholesale,* is now associated with the Weaver Mfg. Co., of Springfield, Ill. In connection with his duties as advertising manager, Mr. Purvis will bring to the activities of the new Weaver educational service and mechanics training school the benefit of his technical training and intimate knowledge of the automotive service business.

M. WILLIAM RADTKE has relinquished the position of experimental engineer that he held with the Buick Motor Co., of Flint, Mich., and his plans for the future are indefinite. At present he is located at Manistee, Mich.

IRA J. SNADER was recently appointed experimental engineer with the Ex-Cell-O Aircraft & Tool Corp., of Detroit. He used to be production engineer of the Wright Aeronautical Corp., of Paterson, N. J.

LLOYD STEARMAN, formerly president, general manager and director of Stearman-Varney, Inc., of Alameda, Calif., is now president and chief engineer of the Lockheed Aircraft Corp., of Burbank, Calif.

JOSEPH VAN BLERCK has founded and is owner of a business under his own name in Long Island City, N. Y., for the manufacture of marine engines, formerly manufactured by the Van Blerck Marine Motors, Inc., a division of the Gifford Wood Co., of New York City, of which division he was president.

ALFRED V. VERVILLE has assumed the duties of consultant on engineering and production for the Aerocar Co., of Detroit. He previously was president of the Verville Aircraft Co., also of Detroit.

A. M. WAUTERS, who was connected with the Olds Motor Works, of Lansing, Mich., for the last five years, was recently transferred to the Buick Motor Co., of Flint, Mich., where he is continuing his work as manifold and carburetion design engineer.

REMEMBER A MEMBER!

Quite recently an automotive executive arrived in New York from France, his native country, in search of an American engineer to undertake an important development abroad. Coming to S.A.E. Headquarters, he was quickly placed in communication with a number of qualified men, one of whom is by now on the high seas headed toward his new position.

The fact that the Society's Employment Service is free to employers and those who seek positions should make it all the more attractive at home as well as abroad.

REMEMBER A MEMBER!

HIGHWAY AND BUILDING CONGRESS AND 13th ANNUAL ROAD SHOW

JANUARY 16 to 20, 1933, DETROIT

S. A. E. Session

Wednesday, Jan. 18

10:00 A. M.—Municipal Airport, Detroit
Chairman—W. G. Fitzpatrick, Eastern Michigan Motorbuses

Topics:

Motor-Vehicle Manufacturing Problems Caused by Lack of Uniform Regulation and Legislation Among States
M. C. Horine, International Motor Co.
National Uniformity in Regulation of Motor-Vehicle Transportation
Pierre Schon, General Motors Truck Corp.

Session Under Auspices of Uniform Committee of Public Utility Commissioners

2:00 P. M.—Municipal Airport

Topic: The Need for Uniformity in Constructive Intra and Inter-State Regulation of Highway Transport

Highway Congress Day

Thursday, Jan. 19—Masonic Temple, Detroit
Topics:

Highway Program of the Nation; Its Present Status and the Outlook for the Future
Importance of Highway Transportation to Economic Recovery
Correlation of Different Forms of Transportation
What Highways Mean to the Economic, Educational and Social Life of the United States
Highways Are Self-Liquidating Projects
Diversion of Motor-Vehicle and Gasoline Taxes
The Interest of the Agricultural Industry in Adequate Highways

Reduced Railroad Fares

Purchase regular one-way ticket from starting point to Detroit. Dates of sale, Jan. 8 to 19.
Secure return fare certificate from ticket agent.
Have certificate validated at the Congress in Detroit between Jan. 16 and 20.
Reduced-rate return tickets should then be purchased in Detroit up to and including Jan. 25. They will be good for 30 days from date of purchase of going ticket. Members in territory east of Mississippi River including St. Louis and Chicago but excepting Wisconsin, Northern Illinois and New England are entitled to one and one-ninth return fares; from other points, one and one-half return fares. It is understood that the one and one-ninth rate will apply to tickets bought outside the one and one-ninth fare territory for that portion of the fare applying in the one and one-ninth fare territory.

General Program for Week

The thirtieth annual meeting and Road Show of the American Road Builders' Association will be held in Detroit, Jan. 16 to 20, coincidentally with meetings of virtually every national organization identified with highway and construction enterprise. These conventions will come to a climax with a two days' general program designated as the Highway and Building Congress.

Among the questions to be discussed are conserving motor vehicle and gasoline tax revenues to the purpose of highway construction and maintenance and the wisdom of a continued highway program to relieve unemployment.

The Road Show will be held at the Detroit Municipal Airport and will feature not only equipment and materials used in highway construction and maintenance but also a large display of motor-trucks.

It is anticipated that the Congress will bring to Detroit the largest number of representatives of the highway and construction industries ever gathered at one time, including Federal, State, county and municipal highway officials, manufacturers of materials and equipment, contractors, distributors, motor-truck operators and manufacturers, insurance company representatives and others whose interests ally them with either highway or general construction enterprise.

The first convention sessions will be held on Monday afternoon, Jan. 16, two of them to run concurrently in rooms available at the Municipal Airport. Reports will be made at the first general session, relating to asphalt, brick and reinforced concrete paving. At the same time, County officials' committee reports will be made—"The Administrative and Financial Relationship of State and County," "The Evaluation of Planning Data," "The Importance of Technical Direction of County Highway Operations," and "County Road Work and Its Relation to Unemployment."

The City Officials' Division will meet on Tuesday morning, Jan. 17. Reports of two committees, on Finance and Traffic, will be made at the opening session. At a concurrent meeting in another room of the Airport, three general committee papers will be submitted, dealing with Single Track Concrete Roads, Graded Aggregate Low Cost Roads, and Use of Emulsions.

The Tuesday afternoon sessions will see the conclusion of the City Officials' Division group meeting when three additional reports will be made by the committee on Design and Construction, Maintenance and Street Maintenance Economics. A meeting of the County Officials' Division, held at the same time, will conclude the committee reports with those on Design and Construction and Maintenance.

The sessions of Wednesday, Jan. 18, will be devoted to the activities of general committees of the Association. Three subjects are scheduled for the morning meeting, relating to pipe and equipment for low-cost roads. The concluding group of four reports will be presented at the afternoon meeting, dealing with equipment for spreading and finishing, truck scrapers, snow plows and hauling equipment.

A special feature of the Wednesday program is the S.A.E. Session, that will run concurrently with the general session and which will bring together motor-truck manufacturers and operators, motor-vehicle administrators of the North Central States and heads of regulatory commissions of the same area. These agencies will meet for the purpose of making a thorough study of reciprocal regulatory statutes with the view toward eliminating the non-uniformity which now imposes so many and such serious restrictions upon motor freight movement between the States.

Other organizations participating in the Highway and Building Congress in addition to the Society are the American Institute of Steel Construction, American Society of Municipal Engineers, American Welding Society (Detroit Section), Asphalt Institute, Associated Equipment Distributors, Associated General Contractors of America, Construction League of the United States, Highway Research Board, International Association of Public Works Officials, Materials Handling Institute with Material Handling Division of the American Society of Mechanical Engineers cooperating, National Association of Builders' Exchanges, National County Roads Planning Commission, National Crushed Stone Association, National Paving Brick Association, National Ready Mixed Concrete Association, National Rural Letter Carriers' Association, National Sand and Gravel Association, Portland Cement Association, Steel Founders' Society of America, Inc., and the Truck Association Executives of America.

The full weight of these organizations will be thrown behind the Highway Day program of the Congress, which will be held on Thursday, Jan. 19. Six papers dealing with as many different vital problems now confronting the highway industry, and delivered by internationally known authorities, will feature the morning and afternoon sessions of this day's program.

Philip A. Glass

Notification has been received that Philip A. Glass, Detroit representative of the Federal Bearings Co., Inc., of Poughkeepsie, N. Y., died at his home in Kalamazoo, Mich., on Nov. 21. Mr. Glass was born Sept. 6, 1886, at Millersburg, Ohio, and was graduated in 1922 from Kalamazoo College with the degree of bachelor of arts.

Mr. Glass' business career began in 1911, when he became salesman for the Chicago branch of the Winton Motor Car Co. In 1916 he entered the employment of the Strom Ball Bearing Mfg. Co., of Chicago, as a sales representative and, in 1926, became connected with the Federal Bearings Co., Inc. He was elected to Associate Member grade in the Society in April, 1928.

Robert L. Trube

A brief notice was received of the recent death of Robert L. Trube, of S. A. Nitroco, consulting engineers, Paris, France.

Mr. Trube was born May 25, 1897, at Joliet, Ill. He was graduated from the Stevens Institute of Technology and received the degree of mechanical engineer in the spring of 1919. Thereafter he was successively connected with the Renault selling branch in New York City as an engineer in charge of purchases of lighting and starting equipment for the Renault factory in France; with the electrical-equipment subsidiary of Automobiles Renault, engaged in installing new production methods in the Billancourt factory; with North East Service, Inc., of Rochester, N. Y., in new application work in Paris and in sales promotion of equipment for new cars in London; and with the North East Service, as sales engineer.

Almost all of Mr. Trube's business career was devoted to the promotion and installation of automobile lighting, starting, ignition and speedometer equipment. He was elected to Associate Member grade in the Society in March, 1927.

NEW MEMBERS QUALIFIED

ALEXANDER, KEITH O. (J) P. O. Box 513, *San Bruno, Calif.*

ANGELL, W. R., JR. (J) research engineer, Continental Motors Corp., 12801 East Jefferson Avenue, *Detroit.*

ARMSTRONG, JOHN A. (J) 575 St. Pauls Avenue, *Grantwood, N. J.*

ASKREN, J. A. (J) research assistant, Purdue University, *Lafayette, Ind.;* (mail) c/o Henry Ehresman. R.F.D. 4.

BIGBY, PAUL STEVENS (J) assistant head automotive engineer, Universal Oil Products Co., *Riverside, Ill.*

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These applicants who have qualified for admission to the Society have been welcomed into membership between Oct. 10 and Dec. 10, 1932

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (S M) Service Member; (F M) Foreign Member.

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NOTES AND REVIEWS

AIRCRAFT

Ein Versuchsflugzeug mit Veränderlicher Tragfläche.

By Werner Schmeidler and Gerhard Neumann. Published in *Zeitschrift für Flugtechn.k und Motorluftschiffahrt,* Sept. 14, 1932, p. 505. [A-1]

Variable wing area has been one of the expedients proposed for decreasing the span between the maximum and the minimum speed of aircraft. The aeronautical department of the Breslau Engineering College has been conducting researches on this possibility since 1928 and has just completed the building of a second experimental airplane with wings of variable area, the constructional and aerodynamic features of which are described in this article.

Zur Theoretischen Behandlung der Gegenseitigen Beeinflussung.

By C. Wieselsberger. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Sept. 28, 1932, p. 533. [A-1]

Publications in the past on the subject of mutual interference in aircraft are stated herein to have covered for the most part experimental determinations on specific aircraft. A need exists for the development of a method of calculating mutual interference, to reduce the task of setting values for new types. Preliminary steps toward this end are taken in the present article, which shows for certain cases how values can be estimated for mutual interference between propeller and fuselage, fuselage and wings and wings and propeller. The author does not put forth any claims for finality or completeness of his method but states that it is indicative of the possibilities involved.

A Comparison between the Theoretical and Measured Longitudinal-Stability Characteristics of an Airplane.

By Hartley A. Soulè and John B. Wheatley. N. A. C. A. Report No. 442, 1932; 16 pp., illustrated. Price, 5 cents. [A-1]

Pressure-Distribution Measurements on the Hull and Fins of a 1/40-Scale Model of the U. S. Airship Akron.

By Hugh B. Freeman. N. A. C. A. Report No. 443, 1932; 15 pp., illustrated. Price, 5 cents. [A-1]

Wind-Tunnel Research Comparing Lateral-Control Devices, Particularly at High Angles of Attack. VI—Skewed Ailerons on Rectangular Wings.

By Fred E. Weick and Thomas A. Harris. N. A. C. A. Report No. 444, 1932; 13 pp., with tables and charts. Price, 5 cents. [A-1]

Working Charts for the Determination of the Lift Distribution between Biplane Wings.

By Paul Kuhn. N. A. C. A. Report No. 445, 1932; 17 pp., with tables and charts. Price, 10 cents. [A-1]

Methods of Recording Rapid Wind Changes.

By A. Magnan. Translated from *Jahrbuch No. 4 (1929) des Forschungs-Institutes der Rhön-Rossitten-Gesellschaft.* N. A. C. A. Technical Memorandum No. 692, November, 1932; 13 pp., 31 figs. [A-1]

Zur Berechnung auf Knickbiegung Beanspruchter Flugzeugholme.

By Alfred Teichmann. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Sept. 14, 1932, p. 511. [A-1]

Bending stress in loaded aircraft wing spars was analyzed in a previous technical note of the German Institute for Aeronautical Research, No. 263. In the present article the most important formulas and methods of calculation used in that note are assembled. Other material supplementary to Technical Note No. 263 is also included.

These items give brief descriptions of technical books and articles on automotive subjects. As a rule, no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.

CHASSIS PARTS

Das Flattern der Vorderräder bei Automobilen.

By R. Wichtendahl. Published in *Automobiltechnische Zeitschrift,* Sept. 10, 1932, p. 409. [C-1]

The investigations described in this article were undertaken in an effort to solve a practical shimmy problem that arose in the production of the Hanomag car. In certain of the new models shimmy and tramp were observed on the test stand but not on the road and vice versa.

Important factors were found to be wheel balance, steering-system friction and caster action. In connection with the last-named feature, laboratory determinations were made of wheel and axle positions as affected by movements of the steering-wheel for cars of seven different makes, and the relationship of these interactions to shimmy is discussed.

An electrical vibration-measuring instrument was then developed for road testing. With this, records could be obtained of all important movements of the front wheels and front axle. Runs were made with a Hanomag car to determine the effects of tire-inflation pressures, shock-absorbers, caster and camber. As a result of the information gained, which is recorded in the article, changes were made in the spring mounting, axle construction, camber and shock-absorber equipment of the Hanomag car and are asserted to have made the car practically free from shimmy.

A subsequent article will essay to explain on theoretical grounds the results obtained.

Prüfung der Lesbarkeit von Kennzeichenschildern aus Aluminiumblech.

By Professor Wawrziniok. Published in *Automobiltechnische Zeitschrift,* Sept. 10, p. 430, and Sept. 25, 1932, p. 452. [C-1]

License plates of sheet aluminum with unpainted background and raised black lettering have recently been introduced in Germany. Tests on the legibility of this type of plate as compared with others of different background and lettering are described. The tests were made in the automotive laboratory of the Dresden Engineering College.

EDUCATION

Engineering: A Career—A Culture.

Prepared and published by The Engineering Foundation, 29 West 39th Street, New York City, 1932; 61 pp. [D-3]

This pamphlet, addressed to young men and to parents and teachers, is descriptive of the profession of engineering; its spheres of action, the training and the qualities required for its successful pursuit, the obligations it imposes and the rewards it affords. The significance of engineering is made clear so as to aid a young man in deciding whether, through this profession, he can realize his ideals and ambitions.

This text has been prepared by the education research committee of The Engineering Foundation, with the cooperation of the societies that its members individually represent.

ENGINES

The Internal-Combustion Engine.

By D. R. Pye. Published by Oxford University at the Clarendon Press, London and New York City, 1931; 250 pp., illustrated. [E-1]

Most writers on the subject of the internal-combustion engine err by attempting to cover too much ground; single volumes dealing with everything from thermodynamics to economics, with voluminous descriptions of current engines thrown in for good measure, are not uncommon. These are uniformly disappointing to the serious student of the subject, and a book like Mr. Pye's, which frankly deals with only one aspect but covers it in a thorough and competent way, is, therefore, especially welcome.

Mr. Pye's chosen subject, that of the fundamental principles of combustion and thermodynamics of the various forms of the internal-combustion engine, is covered with exceptional thoroughness. His own researches, his associations with Ricardo, and his present position as deputy director of scientific research of the British Air Ministry enable him to speak with the authority of a recognized leader and to state facts from first-hand knowledge.

The subject is treated in seven chapters, covering, respectively, introductory principles, engine cycles, fuels, detonation, combustion, thermal efficiency and engine testing. Under each heading the fundamental relations and differences between the three major cycles, namely those of the gasoline engine, the gas engine and the compression-ignition engine, are thoroughly covered. Data from significant research are included wherever necessary to support the principles set forth. If one should venture a criticism, it would be that Mr. Pye might have drawn examples more freely from some recent significant American research work, especially that of the Bureau of Standards and the Society of Automotive Engineers.

Altogether, the book is the best work of its kind which the reviewer has seen and should be welcomed by every serious student and scientific worker in the field of the internal-combustion engine.

Vibration Prevention in Engineering.

By Arthur L. Kimball. Published by John Wiley & Sons, Inc., London and New York City, 1932; 145 pp. [E-1]

This book is an outcome of, and closely follows the outline of, a series of lectures presented at the Harvard Engineering School during the season 1930-1931. It is intended to serve as a reference work for practising engineers and particularly for students in the advanced course in engineering of the General Electric Co.

(*Continued on next left-hand page*)

NOTES AND REVIEWS

Continued

The increasing importance of noise and vibration in the engineering work of the company has brought to the author's attention many interesting problems, he states, and has indicated a need for a convenient reference work on this subject.

The scope of this volume includes all the material necessary for handling effectively any usual vibration problem.

Influence of Several Factors on Ignition Lag in a Compression-Ignition Engine.

By Harold C. Gerrish and Fred Voss. N.A.C.A. Technical Note No. 434, November, 1932; 7 pp., 9 figs. [E-1]

The Effect of Clearance Distribution on the Performance of a Compression-Ignition Engine with a Precombustion Chamber.

By C. S. Moore and J. H. Collins, Jr. N. A. C. A. Technical Note No. 435, November, 1932; 14 pp., 13 figs. [E-1]

Combustion of Gaseous Mixtures.

By R. Duchene. Translated from *Publications Scientifiques et Techniques du Ministere de l'Air*. N. A. C. A. Technical Memorandum No. 694, November, 1932; 20 pp., 11 figs., 37 plates. [E-1]

On the Balancing of Two-Stroke 12-Cylinder Engines.

By Fujio Nakanishi. Report No. 86 of the Aeronautical Research Institute, Tokyo Imperial University, September, 1932; 9 pp. [E-1]

Simultaneous explosions in two cylinders will occur in the two-stroke engines of in-line, V or W type if the cylinders are arranged in the same way as in four-stroke engines. In this paper the author discusses the dispositions of the cylinders and the forms of the crankshafts necessary to fulfillment of the two conditions—explosions at uniform intervals and balancing of inertia forces.

These objects can be attained in the 12-cylinder 90-deg. V and the 12-cylinder 60-deg. W types of engine, according to the author, by using asymmetrical crankshafts.

A New High-Speed Indicator for Internal-Combustion Engines.

By Fujio Nakanishi. Report No. 87 of the Aeronautical Research Institute, Tokyo Imperial University, September, 1932; 17 pp. [E-1]

In this new indicator, which is of the optical type, the natural frequency of the moving part is made very high by greatly diminishing the motion, while the decrease in sensitivity is compensated by lengthening the arm of the optical lever to between 3 and 4 meters. The natural frequency is 7000 to 10,000 per sec. Although the indicator is connected directly to the engine cylinder, a special device prevents the engine vibration from affecting the pressure indication.

Ventilsteuerung mit Ölgestänge.

By W. Stieber. *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Sept. 28, 1932, p. 536. [E-1]

A design for an hydraulic valve gear is described and tests made with it on two single-cylinder and one 10-cylinder barrel-type engine are reported. As a result of the relative advantages and disadvantages disclosed, the conclusion is drawn that in the present state of development the construction is applicable to automotive and to certain types of marine engine, but that for aircraft and marine engines in which simplicity of design and low production cost are preeminently required, conventional actuating means are preferable.

Elektrische Triebwerkausrustung für Luftfahrzeuge.

By Wilhelm Brintzinger and Bruno Bruckmann. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Sept. 28, 1932, p. 541. [E-1]

The present state of the electrical equipment of aircraft is summarized by the authors. Design and operating requirements are set forth and the constructions developed to meet these conditions are described. Finally, the fundamental principles for the further development and standardization of electrical equipment are laid down. These are based on the necessity for reliability, simplicity and light weight.

HIGHWAYS

Proceedings of the Eleventh Annual Meeting of the Highway Research Board. Part I. Reports of Research Committees and Papers.

Edited by Roy W. Crum. Published by the Division of Engineering and Industrial Research of the National Research Council, City of Washington, 1932; 443 pp., illustrated. [F-1]

Under the section, Highway Transportation Economics, two articles of automotive interest besides the annual report have been included. The first, the Air Resistance of Motor-Vehicles, by W. E. Lay, reports tests of the air resistance of motor-vehicle bodies, including a study of test methods and aerodynamic characteristics of some simple body forms. Wind-tunnel tests of highway vehicles are complicated by the fact that a road surface must be provided. Tests were made by four methods: (*a*) model free, no road surface provided; (*b*) using a flat

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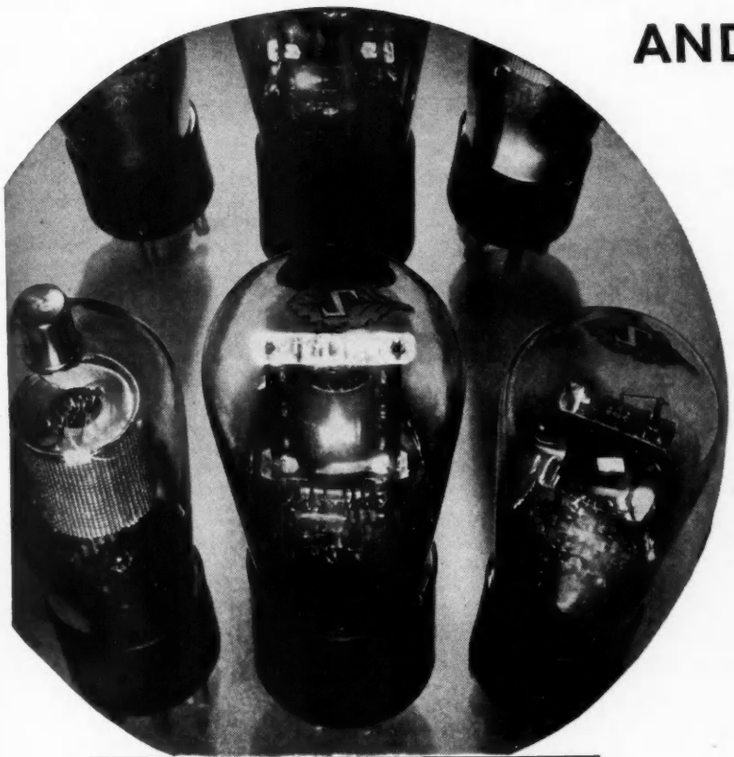
WHEN AUTOMOBILE SET MANUFACTURERS BUY RADIO TUBES . . .

60 TO 70% ARE SYLVANIA-MADE

AND HERE'S WHY!



TWO YEARS AGO the engineers of the Hygrade Sylvania Corporation pioneered by developing a new group of tubes for use in automobile radio.

These new tubes were more efficient in every respect. To the automobile set manufacturer they represented a marked saving in space, in design complexity, in construction costs. To the car owner they meant better reception, fuller volume, less current consumption.

Sets built with the new tubes were *better* than sets built with tubes that had hitherto been available.

Ahead in Design — Ahead in Sales

In designing these automobile tubes Hygrade Sylvania was a full lap ahead of all other tube manufacturers.

Today sales are ahead too. 60% to 70% of all tubes sold for original equipment in automobile radios are Sylvania-made. This is an impressive tribute to the quality of the tube and quality of the cooperation that Sylvania engineers give the individual manufacturer in his circuit and design problems.

Sylvania Tubes are backed by steady, consistent selling effort, both on the air and in national magazines.

Sylvania Engineers have prepared a leaflet containing very complete characteristic data and design application suggestions for all automobile tubes. A copy of it is yours . . . FREE . . . for the asking. Sending for it puts you under no obligation. This booklet is available only to Set Manufacturers and the Executives of Automobile Companies.

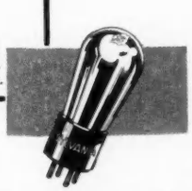
What Sylvania Tubes mean to Automobile Radio . . .

"An automobile set must be about four times as sensitive as a house receiver. At the same time it must be small—compact. The tubes for this job must therefore be of the highest quality and highest efficiency compatible with space requirements.

The Sylvania group of auto tubes is constantly kept abreast of service requirements by the addition of new types as they are required to secure new standards of performance."

R M Wise

Chief Engineer Sylvania Div., Hygrade Sylvania Corp.



Hygrade Sylvania Corporation, Sylvania Division, Emporium, Pa.

Gentlemen: Please send me your Notes and Characteristics folder covering automobile radio tubes.

NAME..... POSITION.....

FIRM NAME..... ADDRESS.....

CITY..... STATE.....

NOTES AND REVIEWS

Continued

plate as the road surface; (*c*) using the flat plate with boundary layer partly removed and (*d*) reflection method, using duplicate models placed bottom to bottom. The data showing the percentage of improvement due to streamlining are said to be fairly consistent when measured by all four methods.

The second paper, Field Methods for Measuring Tire Wear, by A. A. Anderson and H. B. Wright, covers an investigation instigated primarily to obtain information on the methods of conducting field tests to determine the relative tire wear on the various types of road surface. Portland-cement concrete and what is known as a non-skid type of asphaltic concrete were selected with a view to giving a reasonably wide divergence in results.

Conclusions and recommendations are made on the type of vehicle, the relative value of measurements on front and rear tires, the design of tire best adapted to measurement, the length and other details of the test road necessary to secure accurate results, the effect of climatic conditions, the effect of temperature on inflation pressures, the relative value of measurements by depth of wear and by loss in weight and the equipment and personnel.

The section of the Proceedings devoted to traffic also contains material of special interest to the automotive engineer. Vehicle and Highway Mechanics as Related to Traffic-Headlighting, by H. C. Dickinson, covers in general the same data as were reported at the 1932 S.A.E. Summer Meeting and published in the August issue of the S.A.E. JOURNAL.

Traffic Capacity, by A. N. Johnson, covering an investigation of traffic capacity of two, three and four-lane highways, appeared in the May, 1932, issue of *Public Roads* and was reviewed in these columns of the September issue of the S.A.E. JOURNAL.

Law Observance and Enforcement, by Burton W. Marsh, and State Control of Traffic, by W. A. Van Duzer, are also part of the traffic section of the Proceedings.

Eighth Study of Motor-Vehicle Accidents in the State of Connecticut, Including Those for the Year 1931.

By Richard Shelton Kirby. Published for The Hartley Corp. by the Yale University Press, 1932; 51 pp. [F-4]

In this study the primary emphasis is laid on two phases of the motor-vehicle accident situation in Connecticut; namely, the increasing number of persons who are being killed and the persons mainly responsible for killing them, the drivers. As the title suggests, the bulletin is a continuation of a series of studies begun in 1924. The facts are presented in chart form.

A Survey of Motor-Vehicle Traffic in Connecticut in 1931.

Department of Motor-Vehicles, Hartford, Conn., June, 1932; 46 pp. [F-4]

This survey of Connecticut highway traffic was undertaken primarily to obtain essential information concerning the volume, type and character of the traffic now using the highways of the State. The density and composition of traffic, motor-truck and motorcoach traffic, highway utilization and traffic forecasting are covered in the report and form the basis for six recommendations.

MATERIAL

The Catalytic Oxidation of Organic Compounds in the Vapor Phase.

By L. F. Marek and Dorothy A. Hahn. Published by the Chemical Catalog Co., Inc., New York City, 1932; 486 pp. [G-1]

The authors point out that, although oxidation is one of the commonest reactions known and is widely used as a source of energy, it is only within the last 50 or 60 decades that concerted efforts have been made to study individual reactions systematically and apply them in the formulation of useful processes. That the effect of catalysts should have received early attention is only natural, and that some of the earliest observations of catalytic effects had to do with oxidation reactions is worthy of note. In some cases, the authors add, development has been rapid and industrial processes have been worked out; in other cases, troublesome obstacles have been encountered and development delayed.

The authors consider the facts regarding both developed and undeveloped processes and review these critically. The subject is approached through a consideration of the reactions involved and the products formed, showing the effects of different catalysts on the various individual reactions and classifying the catalysts according to their activity and directive power.

Of particular interest is the chapter on The Cause and Suppression of Knocking in Internal-Combustion Engines.

This book is another in the American Chemical Society Monograph Series.

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NOTES AND REVIEWS

Continued

Stainless Steel in Aircraft Construction.

By E. J. W. Ragsdale. Paper presented before a meeting of the aeronautic division of the American Society of Mechanical Engineers at Buffalo, June 6 to 8, 1932. [G-1]

Stainless steel, the author declares, will assume its position in the aircraft industry only when and where the urge is great enough to study its possibilities, to acquire its technique and to overcome the discouragement of first efforts.

To regard it as a panacea is to invite disappointment, and to accept it as a relief from the shortcomings of other recognized materials is a poor excuse. Stainless steel must stand on its own merits, contends Mr. Ragsdale, research engineer for the Edward G. Budd Mfg. Co., who admits to a prejudice, one which, however, has been an inspiration through so many years of experimental work that it has assumed the proportion of a firm conviction.

Developments in Aluminum Alloys in Relation to Economies in Aircraft Construction.

By C. F. Nagel, Jr., and G. O. Hoglund. Paper presented before a meeting of the aeronautic division of the American Society of Mechanical Engineers at Buffalo, June 6 to 8, 1932. [G-1]

This paper reviews the mechanical properties and corrosion resistance of available aluminum-alloy structural materials, and, as to the fabricating situation, discusses the status of technical information, equipment and practices in forming, jointing and corrosion prevention. A summary coordinates these matters to show what has been accomplished and the general direction of present developments, with the thought that the current lull in production provides an opportunity to plan for the future and conduct the indicated experimental work. The discussion is limited to the structural parts of aircraft, such as fuselage and wing and control surfaces, omitting powerplant, landing-gear and accessories.

The Testing of Airplane Fabrics.

By Karl Schraivogel. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Vol. 23, Nos. 16 and 17, Aug. 27 and Sept. 14, 1932. Verlag von R. Oldenbourg, München and Berlin. N. A. C. A. Technical Memorandum, No. 693, November, 1932; 27 pp., 17 figs. [G-1]

Manual of Endurance of Metals under Repeated Stress.

By H. F. Moore. Published by the Engineering Foundation, New York City, 1927; 63 pp. [G-1]

This manual gives in summary form the views and the data upon the fatigue of metals up to 1927, for the particular use of designers, inspectors and testing engineers. A reference list for further study is also included.

The Engineering Societies Library, 29 West 39th Street, New York City, recently announced that it had acquired the remaining stock of this work and is offering it upon application and the receipt of 25 cents to cover the shipping costs.

Die Ursache der Korrosion von Kraftfahrzeugteilen durch Schmiermittel.

By Professor Wawrziniok. Published in *Automobiltechnische Zeitschrift,* Sept. 10, 1932. [G-1]

An investigation intended to throw light upon the causes of engine corrosion by lubricating oil was undertaken in the automotive department of the Dresden Engineering College. The acidity and, through a specially developed method, the electrical conductivity of 70 lubricating oils and transmission greases were determined.

Almost all commercial lubricants were found to have some acid content, which in many cases did not exceed the acceptable limit. Electrical conductivity was found to increase with increasing acid-content, so that many oils which would be considered harmless from the viewpoint of acidity alone, might, by the electrolytic action accompanying acidity, cause corrosion.

Prüfung von Flugzeug-Bespannstoffen.

By Karl Schraivogel. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Aug. 27, p. 489 and Sept. 14, 1932, p. 519. [G-1]

After a short description of characteristics that are desirable in fabrics to be used for airplane-wing coverings, methods suitable for testing material of this type are set forth. The test procedure covered is intended to predict the behavior of the material under the most severe stresses encountered in service. Results of tests are reported and, on the basis of these, the distinguishing characteristics of coarse and fine-woven fabrics, both in their original condition and after soaking, are detailed.

Röntgenuntersuchung von Flugzeugbauteilen bei der DVL.

By Kurt Matthaes. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt,* Aug. 12, 1932, p. 459. [G-1]

Examples of X-ray testing of aircraft parts as conducted by the German Institute for Aeronautical Research tend to show that this type

(*Continued on second left-hand page*)

NOTES AND REVIEWS

Continued

of inspection is especially suitable for welded and cast pieces. By increasing the reliability of aircraft structures, X-ray examination will justify for itself an ever-widening field of application, in the opinion of the author, who thinks that apparatus and procedure for X-ray testing will be still further developed over their present state and so become increasingly useful.

Le Durcissement Superficiel des Aciers.

By Jean Galibourg. Published in *Journal de la Société des Ingénieurs de l'Automobile*, July-August-September, 1932, p. 1826. [G-1]

In an extensive survey of the surface-hardening of steels, the author first describes 13 methods of hardness testing. None of them, he states, is capable of making exact determinations on thin layers of hardened surface, as all of them are based on the principle of forcing a hard body more or less deeply into the test piece and all are affected by the characteristics of the base section of a surface-hardened material. Wear tests, in his opinion, would be more suitable for judging the merits of a case-hardened piece, but for this quality, also, which is not a simple function of hardness, no adequate test is available.

An exposition is then given of the development, processes, merits and application of many methods of surface-hardening, some suitable to large and some to small-quantity production, some well known and some obscure. Among the methods so discussed are the actual welding of one material to another, chromium-plating, case-hardening, nitriding, the cyanide-bath process, successive rapid local application of heat and cooling and cold hammering.

MISCELLANEOUS

Report by the Committee to Study Compensation for Automobile Accidents to the Columbia University Council for Research in the Social Sciences.

Published by the Committee to Study Compensation for Automobile Accidents, Commercial Trust Building, Philadelphia, 1932; 300 pp. [H-1]

This committee became deeply impressed with the great and increasing number of motor-vehicle accidents in the United States and with the seriousness of the problems involved. The problem of compensation for injuries caused by such accidents rather than the problem of accident prevention was the committee's field of study. Therefore a study of the law and the facts with respect to compensation for motor-vehicle accidents was initiated, with the object of presenting an unbiased statement of the findings and suggestions for solutions of the problems. The economic effects of personal injury and death caused by these accidents have been studied rather than the effects of damage to property.

This study has included the investigation of 8849 cases of personal injury and death resulting from motor-vehicle accidents, the assembling of data furnished by public officials and insurance companies, the examination of statutes and judicial decisions and the analysis of pamphlets and articles dealing with the problem.

Particular attention has been given to the operation of the financial-responsibility laws and of the Massachusetts compulsory-liability insurance law and to the probable effects of a system of compensation insurance analogous to workmen's compensation.

Handbook of Industrial Temperature and Humidity Measurement and Control, Parts II and III of The Manual of Instrumentation.

By M. F. Béhar. Published by the Instruments Publishing Co., Pittsburgh, 1932; 420 pp., illustrated. [H-1]

The author points out that in this era of intellectual interdependence, when each science borrows from all of the others, any comprehensive treatise on a new branch of technology must largely take the nature of a symposium rather than that of one author's output, and this handbook has followed that plan. Not only has the material been contributed by a large number of cooperating specialists, but the determination of the contents was governed by a consensus of reports as to existing needs.

The greatest need is said to be the treatment of temperature-control technology; another, a practical text on pyrometry to supplement the Bureau of Standards' Technologic Paper, No. 170, and, in addition, the measurement and control of humidity. The Handbook, which is self-contained, although it comprises only two parts of The Manual of Instrumentation, supplies the fundamental data to meet these needs.

Raketen mit Strahlapparat.

By L. Kort. Published in *Zeitschrift für Flugtecknik und Motorluftschiffahrt*, Aug. 27, 1932, p. 483. [H-1]

Rockets, as used for rocket propulsion, may achieve a great increase in efficiency over their present low nating by the use of a simple device herein described, the author believes. This device utilizes the velocity of the gas stream to draw in fresh air from the direction in which the rocket is moving and eject it behind. Calculations and results of tests,

(*Concluded on next left-hand page*)

In less than two years, the AC 14 mm. spark plug has won the emphatic "OK" of the automobile industry. Ten leading cars in 1933, representing more than half the current production, will have this new and better spark plug as standard factory equipment.

CHEVROLET • CHRYSLER • DE SOTO • DODGE • ESSEX (Terraplane)
NASH • PACKARD • PIERCE-ARROW • PLYMOUTH • PONTIAC

The 14 mm. spark plug was developed specifically for the modern high-compression, high-speed engine. It has a broader heat range than any 18 mm., ½-inch, or ⅞-inch spark plug ever produced. It cools more efficiently. And it is much less susceptible to sooting or fouling troubles. Moreover, this smaller spark plug conserves valuable cooling area in the combustion chamber, and simplifies the design of the cylinder head. It is a logical outgrowth of AC's close co-operation with car manufacturers and engine designers. AC engineering, ever alert to the increasing needs of the industry, meets each new requirement with units of sound design and proved construction. AC engineers will be glad to co-operate with you in fitting your engines with ACs, the spark plugs that insure maximum performance.

AC SPARK PLUG COMPANY, FLINT, MICHIGAN—ST. CATHARINES, ONTARIO

AC SPARK PLUGS • AC FUEL PUMPS • AC COMBINATION FUEL AND VACUUM PUMPS • AC SPEEDOMETERS • AC GASOLINE GAUGES
AC DIE CASTING MACHINES • REMO GUM SOLVENT INJECTORS • AC CRANKCASE BREATHER AIR CLEANERS • AC THERMO GAUGES
AC CARBURETOR INTAKE SILENCERS • AC DIE CASTINGS • AC OIL FILTERS • AC AIR CLEANERS • AC COMPLETE INSTRUMENT PANELS
AC GASOLINE STRAINERS • AC SPARK PLUG CLEANERS • AC OIL GAUGES • AC REFLEX SIGNALS • AC FLEXIBLE CABLES • AC AMMETERS

AC SPARK PLUGS.

NOTES AND REVIEWS

Concluded

which are given, tend to substantiate the claim as to the effectiveness of the device.

Pathways Back to Prosperity. A Study of the Defects in Our Social Machine and How to Mend Them.

By Charles Whiting Baker. Published by the Funk & Wagnalls Co., New York City and London, 1932; 351 pp. [H-3]

According to the author, "the rapidly mounting economic burdens which have developed in city life can best be met by fostering a broad movement back to a very simple self-supporting life on the farm and to the development of local industries in the smaller cities and towns."

Mr. Baker emphasizes the necessity of unemployment insurance, shorter working hours, a tax on luxuries, some better way of doing our banking, destruction of the "fear complex" and a better and more intelligent use of the machine. The problem of distribution also is indicated as one of the most important requiring immediate attention by industry.

Written by a clear-thinking engineer who was editor-in-chief of *Engineering News* for 22 years, the book is well worth attention of others in the field.

"If," writes Mr. Baker, "the brains that created our amazing system of production cannot conceive an equally efficient system of distribution, we shall deserve worse things than we have yet suffered." A real opportunity for the engineer!

Common Sense Applied to Motion and Time Study.

By Allan H. Mogensen. Published for *Factory and Industrial Management* by the McGraw-Hill Book Co., Inc., New York City and London, 1932; 228 pp., illustrated. [H-5]

Mr. Mogensen claims no originality for any of the material included in this book but explains that he has brought together and edited all of the material recently published on the subject of time and motion study and combined with it the subject matter of a series of talks that the author gave to various groups throughout the country. Many of the articles have previously appeared in *Factory and Industrial Management*.

ENGINEERS SEEKING WAY OUT OF ECONOMIC MORASS

DESIGN CHANGES AND REVISED BUSINESS METHODS URGED BY SPEAKERS

FROM start to finish, the Society events of Annual Meeting week in Detroit, Jan. 23 to 26, were characterized by an alert and understanding attitude toward the hard facts of the present and the sensible possibilities of the future. From Dickinson and Scaife to the man who discussed matters of engineering detail—all seemed to be forging ahead steadily with an optimistic eye directed toward the way out of a complex situation.

Stating that "we should get nowhere in science or engineering if problems were handled in the manner in which economic problems have always had to be handled," President Dickinson, in his address on The Mechanics of Recovery, told his audience how the competitive economic system of a nation is in fact a mechanism that responds to laws and forces that are just as definite as those which apply to the phenomena of the scientific realms. He suggested methods for securing continuous prosperity and made many pertinent observations that attract careful study and consideration of his address, which is printed in full on pp. 45 to 53.

Among others who emphasized the need for engineering attacks upon current problems involving our general welfare were T. R. Dahl, of White, who gave a most timely review of highway taxation problems, and B. E. Hutchinson, of Chrysler, who rehearsed the factors that influence the automobile and determine its place in American transportation. Past-President Scaife repeated his encouragement to engineers to contribute their exact methods of reasoning and diversified knowledge toward the solution of our broader questions.

Colonel Ragsdale's address on The Rubber-Tired Rail-Coach reflected the efforts that are being extended by engineers to meet new conditions with new equipment. The same remark would apply equally well to many other papers, several of which looked well into the future.

Streamlining Dramatized

Under the sponsorship of the three Walters—Keys, Lay and Fishleigh—many interesting facts and future possibilities of streamlining were brought out in dramatic fashion. Practical test results were offered to prove that great things can be expected along these lines, not only from the standpoint of performance but with desirable aesthetic attributes as well. Another commentator upon present equipment, and a prophet as well, was A. F. Denham, who spoke about the future of low-pressure balloon tires.

Marking a high spot in the four-day program, the Tuesday evening session presented not only Dr. Dickinson but Past-President Scaife, who yielded the presidential chair with words of sincere appreciation for the cooperation that he has enjoyed. At the same session, the Wright and Manly medals were presented, and Col. C. M. Young ably described the remarkable aids that are offered to air transportation by the Federal airways system.

A production luncheon and technical session gave the manufacturing men their innings. Vice-President Padgett offered an intensely practical paper on tooling, whereas the human equation in production and the rehabilitation of industry were discussed by headliners of the industrial and financial worlds.

Aircrafters Have a Day

Aircraft men and other "streamliners" enjoyed an inspection visit at the wind-tunnel laboratories of the University of Detroit. A session that was full of meaty information attracted many who were looking for something useful on such subjects as aircraft-engine cooling, flight testing and equipment, and propellers.

Automotive Diesel matters formed the basis of a well-attended meeting, while one of the Society's most active groups enjoyed a crowded program of research material on fuel problems and lubrication.

Automatic transmissions popped up under the auspices of Walter Keys; and E. E. Wemp read the A-B-C of clutch design from his educated primer.

As if all this were not enough, the designers and producers of the meeting, under the generalship of N. G. Shidle, of the Meetings Committee, and members of the Activity groups, presented men who knew whereof they spoke on such subjects as cushion-spring comfort, results gained from foreign body designs, aluminum cylinder heads, riding comfort,

shock-absorbers and several other topics for good measure.

Herbert Chase stepped gallantly forward to disturb the comfort of any engineers who might be found slumbering amid dreams of self-satisfaction for past accomplishments. His "pertinent pokes," as he called them, paid pointed attention to "low-down" engineering.

Students Turn Out in Force

Special mention should be made of Harry Woolson's Student Session that was attended by nearly 800 members and guests, the latter being for the most part students from Detroit and vicinity.

In summary, aircraft, Diesels, bodies, engines, chassis, production, research, economics, fuels and philosophy—an extremely wide range of engineering topics —were admirably handled by competent men who addressed some 17 sessions. Considerable work was accomplished at 20 or more Committee sessions.

A noteworthy feature of the meeting was the formation of a new Professional Activity, to be known as the Fuels and Lubricants Activity. In granting recognition of this group, the Council appointed Dr. A. E. Becker as Vice-President of the new Activity.

The Motorcoach and Motor-Truck Rating Committee approved of a method for rating motor-trucks and recommended to the Council that it should be published for a trial in practice.

The Society's 1933 Annual Meeting was very well attended and favorably received, which was adequate compensation to the many competent members who contributed toward its success. At the final windup, when Detroit played dinner host to the members, little if anything was left to be desired.

TRUCK REGULATION BROUGHT INTO OPEN

First Session of Meeting Devoted to Present Crisis in Motor Transportation

THE PAPER by T. R. Dahl on legislation affecting motor transportation dealt with its critical importance to the manufacturers, operators and the Nation as a whole. Mr. Dahl stated that the industry is conversant with these facts but that the general public is not. He said that 45,000 communities in the Country have no rail facilities but must depend upon highway transport. Practically nine of every ten trucks are privately owned and operated and must meet restriction the same as common carriers in intrastate and interstate traffic, which constitute about 1 per cent of all the trucks in operation. In stating that 2,200,000 people in the United States own and operate one truck each, he pointed out that only 15 railroad companies own 85 per cent of the railroads.

Referring to the claims that motor-trucks are destroying the highways, Mr. Dahl stated that scientific determinations show that modern 7-6-7-in. road construction is as safe for 5-ton trucks on pneumatic tires, which is less than 7 per cent of the total traffic, as for passenger cars and that they will will carry 500 vehicles per day for 20 years or 2000 per day for five years before wearing out under impact. An interesting statement was that land grants to the railroads approximate the aggregate area of Germany and Great Britain.

Trucks Pay More Taxes than the Railroads

In 1931, Mr. Dahl said, railroads paid approximately $210,000,000 in total taxes as against $293,000,000 paid by the motor-truck industry. In Texas alone motor-trucks paid twice as much in special taxes as the railroads paid in regular taxes. Taxes and the severe restrictions in Texas alone have driven 30,000 motor-trucks out of business in that State.

Mr. Dahl indicated that 90 per cent of the motor-trucks are operated as industrial tools not in competition with the railroads, and that in 1931 motor-trucks competed with the railroads on only 2½ per cent of the ton-mileage of the railroads. This was practically all L.C.L. freight, which constituted only 2½ per cent of the total tonnage of the railroads and required 26 per cent of all the freight cars in service.

In concluding his paper, Mr. Dahl referred to the efforts that are being made, by backing severe restrictions, higher taxes and controlled competitive rates, to drive motor carriers off the roads and to revert passenger and freight traffic to the railroads in spite of testimony that no demand has been made by the public for such rate control. Finally, he stated that the railroads will not agree to regulations determined by established, scientific facts, and that their efforts must be met in kind, for, after all is said, all transportation systems must eventually be coordinated so that the public will be served efficiently and economically.

Discussion of the Paper

When the meeting was opened for discussion, T. C. Smith stated that the tendency is to present the matter of restrictive truck legislation to the public in a spectacular way to gain attention. He illustrated this by the demands for regulation of interstate trucking, which constitutes only about 1 per cent of the trucking under consideration and is insignificant in importance. He said it seems desirable to expose this and similar unimportant items and to give greater consideration to the relatively small number of really important factors.

J. F. Winchester said the automotive industry feels that it is bearing its proper share of the tax burden, while the railroads hold the opposite view. Anything that can be done to draw these contending views together will benefit the industry. He said we are selling ourselves over and over on the fairness of our position, but need exists for a more definite plan of action than has yet been devised.

Mr. Winchester continued by saying united action by the leaders in the industry is needed to select and financially support strong outstanding local organizations that are now functioning inefficiently, and in some instances help Sections of the Society by financial support in their communities on the basis that in a number of States legislative committees and highway organizations place considerable confidence in the impartial findings of the Society. Another outstanding condition he referred to is the probable curtailment of both passenger-car and motor truck activity if excessive taxes are continued. Taxes are so high in some agricultural communities that it is cheaper to return to the horse-drawn vehicles.

During the coming year some States will endeavor to increase license fees because of evasion of gasoline taxes, asserted Mr. Winchester, who cited one State that is considering the possibilities

of increasing revenues in which it was pointed out to officials that they were failing to collect at least $1,500,000 from present sources, which would give them a considerably larger amount if collected than they anticipated by increasing fees. In concluding, Mr. Winchester expressed the hope that the representatives of the automotive industry will coordinate the activities of the various groups concerned with this subject to avoid overlapping, which at present imposes an unfair burden upon those contributing toward maintaining the position of the industry.

Three Fundamental Factors

Edward P. Warner stated that we may overestimate what we can accomplish by burying the general public and their legislators under a landslide of specific facts. For the ordinary citizen there are three fundamental factors in the situation: first, the railroads are essential to our continued existence; second, the railroads are in a horrible fix; and third, since the citizen can't discover anything else on which to pin the blame, he assumes that highway transport must be responsible.

While it is all very well to say that we have no quarrel with the railroads, continued Mr. Warner, we cannot refrain from giving considerable attention to their condition, which is exaggerated by the public imagination. Up to 1929 the railroads, as a whole, were in splendid shape, with earnings increasing almost steadily. Since then they have suffered with the rest of the world, but their sufferings have not been peculairly acute because of what now appears as recklessness. However disinclined we may be to start the combat of direct charge and countercharge, that is the sort of thing we must tell the public if we are to gain their sympathy. It is not sufficient to invite them to follow us in our reasoning upon how completely the present taxation of highway vehicles satisfies the demands of pure equity.

Educate Economists and Bankers

M. C. Horine said we too often merely get together and sell one another on ideas with which we are all in sympathy, while everywhere in the public press and in public utterances erroneous statements and fallacious conclusions are given. There seems to be a good basis for the opinion, he said, that some of our difficulties arise from ignorance in high places. Perhaps efforts directed toward the education of our economists, college professors and bankers would be more effective than those aimed at legislators and the public. It seems perfectly evident that the railroads are using the alleged truck and motorcoach competition as a stalking horse to conceal their inefficiency and the instabilities of their financial structure.

A. J. Scaife expressed the views that the Society has consistently refrained from going into commercial and legislative matters but that, having got actively into the field of vehicle operation, it must

T. R. Dahl

go farther than pure engineering by paying more attention as a Society to the broader field of activities and exert its influence to hold its rightful position in the motor-transport industry. He also said that the Society should influence its members as individuals to help support the work of the Highway Users Conference and similar active groups in support of motor transportation.

It is too late now for new facts to be effective, said Pierre Schon, so far as State legislation in 1933 will bear on the motor-truck industry. He stated that the matter of new regulations to pave the way for greater taxation of motor-vehicles is now practically in the hands of State legislators as the result of organized campaigning and publicity by the railroads. Mr. Schon then cited the increasing capital structure of the railroads compared with its decrease in the automotive industry, and stated that the railroads' legislative programs are intended as a smoke screen to cover their serious situation. He concluded by stating that the fate of the automotive industry for the next few years will be decided by State legislators this year and that every member of the Society is vitally interested because, if bills are passed ruling motortrucks off the roads, taxes will be greatly increased.

In referring to the need for more effective campaigning by organized automotive groups against pending legislation, Leo Huff described a method of campaigning by personal contact with legislators and stated that one difficulty encountered in raising sufficient funds is that in many cases there are members on the boards of directors of large companies who should contribute, who are also on the boards of railroads and banks and other institutions holding their funds.

At the conclusion of the discussion, both A. F. Coleman and A. H. Gossard urged greater financial and moral support of organizations already actively working on the legislative situation and emphasized the necessity of more thoroughly coordinated organization and effort on a national scale, with ample financial support, to prepare bills in the interests of motor transportation that can be sent to the legislatures with ample backing to secure their enactment.

T. and M. Activity Business Session

Chairman A. S. McArthur convened the session as a stated business meeting of the Transportation and Maintenance Activity of the Society to elect the Nominating Committee which is to select the nominee for Vice-President of the Activity to serve during the year of 1934. In accordance with the procedure prescribed by the by-laws of the Society, F. K. Glynn, E. F. Lowe, A. F. Coleman and M. C. Horine were duly elected, with T. C. Smith and B. B. Bachman as alternates.

DIESEL-ENGINE GROUP ENTHUSIASTIC

THE UNEXPECTEDLY large attendance at the meeting of the Diesel-Engine Activity Committee betokened an interest in this field which was more than supported by the enthusiasm of the members expressed in constructive plans for the Committee's work throughout the coming year.

Under the leadership of Vice-President Harte Cooke, the Committee arranged for a cooperative contribution and inter-

MEETINGS CALENDAR

BALTIMORE—FEB. 16

Emerson Hotel; Dinner 6:30 P.M.
Subject: Highway Transportation

CANADIAN—FEB. 15

Royal York Hotel, Toronto; Dinner 7:00 P.M.

CLEVELAND—FEB. 13

Cleveland Club; Dinner 6:30 P.M.

Automotive Developments of 1933—Austin M. Wolf

DAYTON—FEB. 16

Engineers' Club of Dayton; Dinner 6:30 P.M.

This Research Business—T. A. Boyd, Chief of Fuel Section, General Motors Corp. Research Laboratories

DETROIT—FEB. 21

Book-Cadillac Hotel; Dinner 6:30 P.M.
Ladies' Night

INDIANA—FEB. 8

Indianapolis. Review of the Shows

METROPOLITAN—FEB. 16

Hotel New Yorker, New York City; Dinner 6:30 P.M.

The Marine Division and the Aviation Division will hold simultaneous sessions after dinner.

Langley Field Tests on Location of Engine Nacelle with Relation to Airplane Wings—Dr. George W. Lewis

Wing Flaps—A. A. Gassner

Marine subjects to be announced later

MILWAUKEE—FEB. 1

Milwaukee Athletic Club

Review of 1933 Automobile Shows—H. L. Horning, President and General Manager, Waukesha Motor Co.

Review of 1933 Road Shows—P. W. Eells, Assistant to the President, Le Roi Co.

NEW ENGLAND—FEB. 8

Walker Memorial, Massachusetts Institute of Technology, Cambridge, Mass.; Dinner 6:30 P.M.

NORTHERN CALIFORNIA—FEB. 14

Elks Club, San Francisco; Dinner 6:30 P.M.
"Jinks" Meeting

NORTHWEST—FEB. 3

Bergonian Hotel, Seattle; Dinner 6:30 P.M.
Welding, Cutting and Spraying of Steel or Other Metal

OREGON—FEB. 3

Multnomah Hotel, Portland; Dinner 6:30 P.M.

PHILADELPHIA—FEB. 8

Auto Trades Association, 715 North Broad Street; Dinner 6:45 P.M.

The 1933 Automobile—John A. C. Warner
Engines—Charles O. Guernsey
Bodies—Walter Graf and Joseph Geschelin
Transmissions—P. M. Heldt
Truck Trends—James W. Cottrell

PITTSBURGH—FEB. 21

Fort Pitt Hotel; Dinner 6:30 P.M.

The Engineer's Viewpoint on Service—Alex Taub, Development Engineer, Chevrolet Motor Co.

Service Engineering—B. H. Eaton, Motor-Vehicle Supervisor, Bell Telephone Co. of Pennsylvania

SYRACUSE—FEB. 6

Onondaga Hotel; Dinner 6:30 P.M.

Automotive Developments of 1933—Austin M. Wolf

WASHINGTON—FEB. 15

Racquet Club, City of Washington; Dinner 6:30 P.M.

change of technical data relative to major factors of design and operation affecting the successful utilization of the automotive type of Diesel engine. This plan provides a means whereby the Research Department of the Society, under the guidance of a special committee of the Activity, is to act as a clearing-house in the collection and dissemination of this technical information through available channels, such as general meetings of the Society, Section meetings, the S.A.E. JOURNAL and committee reports.

Among the paramount problems needing specific attention were mentioned cooling, lubrication and fuel. It was emphasized that the Diesel engine has presented, particularly in its industrial applications, cooling difficulties which might readily be overcome if existing data in that art could be placed at the disposal of designers. The same probably is true in the matter of effective Diesel lubrication. There was unanimous agreement that Diesel-fuel research should be pushed, with special emphasis on the determination of availability of each type of fuel as well as its operating characteristics, having due regard for the interrelation of engine characteristics responsible for factors in fuel requirement.

The Chairman was authorized to appoint a membership committee to direct the efforts of the members to pledge themselves to support individually and collectively an intensive campaign for membership increase in the Activity.

TO STANDARDIZE OIL TANKS AND TRUCKS

AT A MEETING of the Motorcoach and Motor-Truck Division of the Standards Committee on Tuesday afternoon, Jan. 24, at which M. C. Horine presided temporarily, probably the most important project discussed was the setting up of a committee to cooperate with a committee of the American Petroleum Institute, of which J. F. Winchester is Chairman. The purpose is to establish standards for gasoline tanks and tank trucks for use on both present types of motor-truck and new types that may be developed in accordance with restrictions that are expected to be incorporated in new legislative regulations by 43 States this year. The S.A.E. cooperating committee, of which A. J. Scaife was elected Chairman, will consist of representatives designated by the leading motor-truck manufacturers, and it is hoped that a definite program of standardization will have been developed by next fall.

The Division was able to report only progress in connection with its standardization of tractor-semi-trailer couplings for interchangeability. The Subdivision is being reorganized to include truck manufacturers and operators as well as the trailer manufacturers.

Last year, at the request of the National Automobile Chamber of Commerce, a subdivision was organized to formulate a definition of what constitutes a standard motor-vehicle chassis. The report of the subdivision is being referred to the Division members for their approval.

Other subjects discussed but on which no final action was taken are suggested modifications of the present standard

Chassis Record Form adopted last year and possibly the development of a new construction of Pintle Hook and Eye to supplement the Pintle Eyes adopted by the Society. The latter was referred to the Transportation and Maintenance and Motorcoach and Motor-Truck Activity Committees for further study.

RAIL-COACHES AS LATEST DEVELOPMENT

Pneumatic Tires and Welded Stainless Steel Are Comfort and Economy Factors

AT THE Motorcoach and Motor Truck Session, E. J. W. Ragsdale's paper was presented by H. Henkle because of illness of the author. It described the principles involved in the latest development of pneumatic tires and wheels for motor rail-coaches and of strong light-weight frame and body construction to meet the crisis in economic railroad operation and promote greater safety and comfort. Following a detailed description of the horseshoe type of tire and its performance, the paper emphasized the need for light truck and car-body construction. The paper is printed in full in this issue, beginning on p. 54.

Numerous Questions Answered

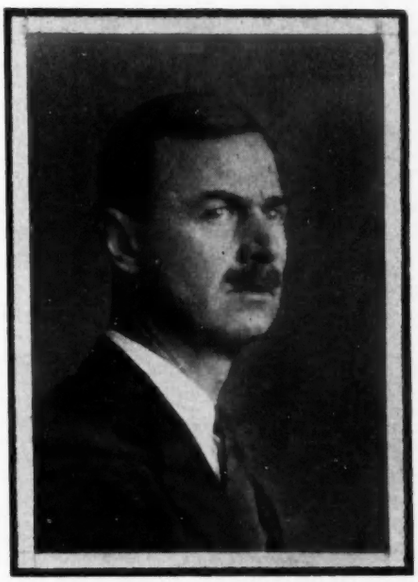
In reply to a question by B. J. Lemon regarding tramp or teetering, Mr. Henkle replied that the builders had tried rubber springs but discontinued these because they caused car-jumping; the present tire equipment gives no trouble.

A. H. Gossard asked whether any difference is noticeable in road-bed troubles with light-weight rail-coaches due to their low center of gravity, to which the speaker replied that no data are available.

L. K. Snell asked why stainless steel is used instead of aluminum, to which the speaker answered that, strength for strength, the rail-coach can be built more cheaply of steel.

In response to M. C. Horine's question regarding the effect of a deflated tire, Mr. Henkle said that the company had shot one, with no noticeable effect, and that the car had run 35 miles without trouble until the tire was changed.

J. A. Anglada questioned the power requirement on minimum curves, to which Mr. Henkle replied that the power is not affected, as the drive is on the rear truck through two worm-drive axles provided with differentials.



E. J. W. Ragsdale

Chairman Bachman said that the paper indicates a practical way in which automotive engineering experience can be applied to economic problems confronting the railroads. The development of the pneumatic tires and suitable structures and production methods using stainless steel are of particular interest in building road vehicles where the factors of weight reduction are of importance.

Drag Reduction versus Weight Saving

C. O. Guernsey said that some of the conclusions might be questioned in that the importance of light weight is stressed while the key to the design described is to keep the weight within the limited capacity of pneumatic tires on a rail head. It was his opinion that a reduction of 1 sq. ft. in frontal area is more important than 1 ton of weight and that perhaps moderate streamlining is more important than either, as the rolling resistance of steel wheels on steel rails is very low and railroad grades ordinarily do not exceed 1½ per cent. We cannot afford, he said, to pay a high premium in first cost or in maintenance to achieve light weight.

The design shown is predicated on non-interchangeable service, while rail-cars must be capable of handling one or more trailing cars of standard design, continued Mr. Guernsey. The trend during past years has been toward higher power to give greater selection of standard trailing equipment and, when realizing that the rail-car designer has no control of the trailing equipment, it is apparent that little can be done even in streamlining. The day of the single-unit motor-car for branch-line service is gone, but single units of specially designed self-contained trains may have a field in frequent high-speed service between cities, generally without stops.

Election of Nominating Committee

The session was convened by Chairman B. B. Bachman as a stated business session of the Motorcoach and Motor-Truck Activity to elect the Nominating Committee to select the Vice-President of of the Activity for 1934. Those elected are R. L. Buckendale, C. O. Guernsey, B. F. Wright and Pierre Schon, with A. J. Scaife and A. G. Herreshoff as alternates.

TRUCK ADVISORY AND RATING REPORTS

JUST one year ago the Military Motor-Transport Advisory Committee, of which B. B. Bachman is Chairman, was organized by the Council of the Society to consider in an advisory capacity certain proposals of the Quartermaster Corps of the Army in connection with military motor-transport equipment. Meetings of the Committee were held in Detroit, White Sulphur Springs and Toronto at which the solution of the problems before the Committee were gradually crystallized and resulted in definite recommendations at the meeting of the Committee in Detroit on Jan. 25 for submission to the Council for final disposition. The organization of the Committee will be retained so that it will be prepared to continue its cooperative work in the future as occasion may require.

At a meeting of the Motorcoach and

Motor-Truck Rating Committee, of which L. R. Buckendale is Chairman, in Toronto last October, the draft of a method for rating motor-trucks was completed, and this was circulated to the members of the Committee for final consideration. At the meeting of the Committee in Detroit on Jan. 26 the draft was approved, with a slight modification, for submission to the Council of the Society with the recommendation that, if approved by the Council, it be published for a trial in practice, looking toward further action by the Committee in the future regarding its adoption as a standard of the Society.

AIRCRAFT ENGINES AND FLIGHT TESTING

Engineers Discuss Engine Cooling and Airplane Speed in Relation to Engines and Propellers

J. H. Geisse

UNDER the chairmanship of P. B. Taylor, the Aircraft-Engine Session opened with the selection of F. W. Caldwell, L. S. Hobbs, Arthur Nutt and Prof. F. W. Pawlowski as members of the Aircraft-Engine Activity Nominating Committee. Opie Chenoweth and R. N. DuBois were chosen as alternates. J. H. Geisse then presented his paper on Indirect Air-Cooling of Aviation Engines.

Indirect Air-Cooling Considered

Mr. Geisse reviewed the development of the cooling system with which he has been identified, with the cooperation of the Bureau of Aeronautics of the Navy Department, and which is miscalled Prestone or sealed liquid-cooling. The first engine designed and built expressly for indirect air-cooling was described and the results of tests with it were shown by charts. The speaker pointed out how faults in the engine, which were not corrected before the tests were made, caused a high friction loss, with a consequent drop in horsepower, and excessive oil heating. The significance of various test results was discussed and Mr. Geisse then considered the adaptability of the system to larger engines and spoke of its advantages over other systems, finally visioning a likely future powerplant installation with the engine below the cabin in an airplane.

Ford L. Prescott, of Wright Feld, read written discussion submitted by Arthur Nutt, who recommended that the cylinder-wall temperature be reduced to 250 deg. fahr. and suggested that cooling a six-cylinder engine of larger bore or a 12-cylinder engine in this manner would present a serious problem. Mr. Nutt also regarded the cylinder distortion mentioned as likely to cause trouble. L. P. Saunders, of the Harrison Radiator Co., commented on heat dissipation to the air-stream and the Chairman remarked that, while this engine is partly liquid-cooled and partly air-cooled, the portion directly air-cooled appeared to have given most of the trouble.

Airplane Performance

Since the next three papers came from United Aircraft & Associated Companies, they were treated as a group. The first, on Commercial Flight Tests, Equipment and Methods, was presented by A. L. MacClain, Pratt & Whitney test pilot.

The paper purposed to show that the value of commercial flight-testing depends largely upon the utility, reliability and accuracy of the equipment and instruments employed. In general, the authors found that these three factors are proportional to the simplicity of the apparatus used. Special engine tests led to the development of instruments and apparatus not available commercially, and their use made it possible to employ the aircraft engine as an instrument for measuring power during flight. This led to the development of a method of making comparative engine-temperature and other tests, which eliminates or corrects for a number of major variables. Because of the increasing popularity of the controllable-angle propeller, tests were also described which enable the value of such a propeller to be determined when only an adjustable-angle propeller is available.

Maximum Speed Testing

This was followed by Airplane Flight-Testing for Maximum Speed, which was given by a United Aircraft test pilot, H. W. Fairchild. It dealt primarily with items affecting the maximum speed of airplanes in level flight and described methods and technique that have given satisfactory results. The relation between the available thrust horsepower and the power required to overcome both induced and non-induced resistance was given, and the relative effects of changes in propeller characteristics and other items were discussed and illustrated with examples from practice. The authors outlined a method of calibrating engine-manifold pressure and using the calibra-

A. L. MacClain

H. W. Fairchild

tion in determining engine power in flight.

Reduction of measurements of maximum speed at altitude to standard altitude conditions was discussed, but special emphasis was laid on methods of measuring comparative speeds of an airplane on which various modifications have been made, with a view to ascertaining the aerodynamic effects of the changes. They showed that in general the maintenance of a constant density-altitude and constant engine power or airplane speed is most satisfactory, and described charts for enabling the pilot to attain these conditions in flight.

Choosing the Right Propeller

The last paper was The Correlation of Propeller and Engine Power with Supercharging, by F. W. Caldwell, of the Hamilton Standard Propeller Corp. This was an exposition of short-cut methods of arriving at approximations for choosing the most suitable metal propeller of established design for transmitting the most engine power for maximum and cruising speeds at altitude or for take-off and climb.

Reasons for the selection of the methods of analysis were given and the extent of their accuracy was evaluated. One propeller was found to give an increase in cruising speed of 8 per cent over the best speed obtainable from a propeller chosen in the usual way.

The authors showed how many of the disadvantages resulting from use of an unsuitable propeller can be overcome by a propeller, the pitch of which can be adjusted in flight to definite values most needed for certain performance characteristics. Short-cut methods for estimating the engine power available for take-off and climb with different propellers were outlined and a chart for estimating the change in propeller speed that results from a change in airplane speed was given.

The discussion centered around the Pratt & Whitney method for determining engine horsepower in flight by calibration charts and observations of intake-manifold pressure, carbureter air temperature and atmospheric humidity. The use of a hub dynamometer was suggested, and K. J. De Juhasz mentioned the hydraulic instrument developed by Dr. Bendemann at the D.V.L., but Edward P. Warner pointed out that such instruments are still in an experimental stage, as shown by tests at Langley Field and substantiated by a recent visit to Germany, while the added weight of the device would tend to alter test conditions. H. K. Cummings inquired regarding the correction for exhaust back-pressure, and Mr. Fairchild replied that the correction used was based on tests that were made several years ago in the altitude laboratory at the Bureau of Standards.

METHOD OF ANTI-KNOCK MEASUREMENTS

DURING the progress of the C.F.R. Detonation Subcommittee's research toward the development of satisfactory methods for measuring the detonating tendencies of motor gasolines, and particularly since the recent road-test project which resulted in the adoption of the C.F.R. Motor Method and the Road-Test Procedure, there has been insistent demand that the Committee undertake a program directed toward obtaining comparable methods for evaluating aviation gasoline.

F. W. Caldwell

Results of Preliminary Conference at New York City

In response to this demand, a conference of aircraft-engine builders and aviation-gasoline producers was called in New York City on Jan. 12 to consider ways and means for developing such a program, and a special subcommittee was appointed to analyze all data that could be made available relative to the results of tests and methods of test on multi-cylinder aircraft engines, together with data relative to any laboratory methods that have been found to give reasonable correlation with performance in multi-cylinder engines.

After thorough examination of these data, the Subcommittee recommended to the main Committee at its meeting on Jan. 25 a proposed program of engine tests on three groups of representative aviation gasolines. This program was adopted with minor modifications by the main Committee, together with definite plans for its consummation.

As a temporary measure pending the development of a satisfactory aviation method, a tentative procedure for making tests on straight-run gasoline was drawn up.

The intention of the Committee to seek the sponsorship of the Cooperative Fuel-Research Committee for the aviation-gasoline detonation undertaking was formally expressed at the meeting in New York City and the plan for attaining this end was further developed at the Jan. 25 meeting in Detroit.

REWARD FOR LONG MEMBERSHIP

CHAIRMAN Walter Keys called the first formal meeting of the Life Membership Committee on Monday evening, Jan. 23, to discuss plans for a suitable reward for members of the Society of long standing. Past-President Scaife, President-Elect Dickinson and Ralph Teetor aided in formulating a plan of life membership as a fitting tribute for those members who, through continued affiliation, have helped to build up and maintain the

work and activities of the Society.

The plan as discussed is to be referred to the full Committee and the Council for further consideration before placing it before the membership for a final decision.

THE PRESIDENCY CHANGES HANDS

Scaife Presents Dickinson at Business Session Preceding Aircraft Address and Medal Presentations

ALTHOUGH, according to the Constitution, a new president of the Society does not take office until the conclusion of the Annual Meeting, Mr. Scaife made Dr. Dickinson feel very much in the harness when he presented the new President to a large audience that had come to hear him discuss his Mechanics of Recovery at the Tuesday evening session. Preceding the introduction, however, Mr. Scaife reviewed the Society's progress during the period of his administration and expressed keen appreciation for the helpful cooperation that he had received from a host of members. He opined facetiously that he and Herbert Hoover had picked a tough time to be president of anything.

Nominators-at-Large Chosen

President Scaife called the Annual Business Session of the Society to order and asked that the members choose three members and two alternates for the Annual Nominating Committee. Ernest Wooler, R. R. Teetor and A. G. Herreshoff were chosen for the major rôles, with J. F. Winchester and C. O. Guernsey as alternates.

Before calling for adjournment of the Business Session, President Scaife reported Council adoption of 10 Division reports of the Standards Committee, following which he announced the entire list of officers for the 1933 administrative year.

President Dickinson on Economic Recovery

After expressing his appreciation of the honor that the Society has bestowed upon him in electing him to the presidency, Dr. Dickinson gave his address on The Mechanics of Recovery that is printed in full on pp. 45 to 53 of this issue of THE JOURNAL. He emphasized his desire to receive comments and questions regarding his thesis and urged his listeners to give him the benefit of their constructive ideas in writing.

COL. C. M. YOUNG

Stout Leads Aircrafters

Following a pleasant introduction by Chairman William B. Stout, Col. Clarence M. Young, Assistant Secretary of Commerce for Aeronautics, regaled some 200 members and guests at the Aircraft Session, following the Annual Business Meeting, with an interesting descriptive story of the Federal Airways System that has seen such remarkable development under his guidance.

He reported that the plans for Federal airways call for routes totaling 25,000 miles, of which approximately 19,500 miles have been completed to date. This system, open to all air-transport units, comprises six major aids to organized transportation, he said.

Rotating beacon lights, located at intervals of 10 to 15 miles, with suitable course lights, are among the major units of equipment. Some of these are supplied by commercial power, whereas others in remote places are equipped with self-generating units that will operate for months without attention. Control is by astronomical clocks, although the photo-electric cell promises to replace these timing devices.

Intermediate fields constitute the second important aid. Averaging about 65 acres in area, these fields are located at 50-mile intervals. They are equipped with runways that average ½ mile in length and upon them all necessary lighting and marking equipment is to found. It is interesting to learn that 98 per cent of the landings that are made at these intermediate fields are occasioned by bad weather conditions, not by failure of the aircraft.

Third in the list of aids, the radio stations were mentioned. It seems that 69 of these are in operation at locations 200 miles apart. They broadcast weather information primarily.

Ninety-eight radio range-beacons, each covering a radius of 100 miles, are now broadcasting automatically the A-N signals that enable the pilot to keep on his true course.

Marker beacons, low-powered stations, are found at certain intermediate fields and at special points from which emergency weather information is sent for broadcasting to the pilots.

Finally, there are 13,000 miles of teletype operation which provides for the dissemination and collection of weather information at important centers. Pictures of weather conditions are now being sent in the form of maps by teletype. This service is being installed at 71 points.

In closing his address, Colonel Young, who is now a Vice-President of the Society, mentioned the research work of his department and expressed the hope that the constructive airway aids of the Government may be continued and extended for the benefit of air transport in this Country.

Activity Nominators Chosen

At a business session of the Aircraft Activity, conducted by Vice-President Stout following the Young address, A. V. Verville, R. H. Upson, Edward P. Warner and J. H. Geisse were elected as members of the Activity Nominating Committee. J. M. Miller and W. B. Stout were chosen as alternates.

The final item on a full evening's program was the presentation of the Wright and Manly medals.

AIRCRAFT MEDALS AWARDED FOR 1932

Wright Bros. Medal to Edward P. Warner, and Manly Memorial Medal to F. L. Prescott

THE Aircraft Session of the Annual Meeting, on the evening of Jan. 24, was the scene of the presentation of the Wright Bros. and Manly Memorial Medals, which were awarded respectivly to Edward P. Warner and Ford L. Prescott, who in the opinion of the judges of award made the outstanding contributions to the industry in the form of papers delivered before the Society or any of its Sections during the calendar year 1932.

The members of the Committee of Award of the Wright Bros. Medal for 1932 consisted of Ralph H. Upson as Chairman, Glenn L. Martin and T. P. Wright, and the presentation to Mr. Warner was made by Chairman Upson on behalf of his Committee.

Because of the absence of Chairman Wesley L. Smith of the Committee of Award of the Manly Medal, and at his instance, William B. Stout, Vice-President of the Society representing Aircraft Engineering for 1932, presented the medal to Ford L. Prescott with a short address. The other members of the Committee of Award for 1932 were E. E. Wilson and Arthur Nutt.

EDWARD P. WARNER

FORD L. PRESCOTT

The winning paper by Mr. Warner, which was entitled The Rational Specification of Airplane Load Factors, was originally presented before the Aeronautic Meeting of the Society in Detroit last April, and printed concurrently in the April, 1932, issue of THE JOURNAL. Mr. Prescott's paper, Indicators as a Means of Improving Aircraft-Engine Performance, was delivered before the Aeronautic Meeting of the Society at Cleveland in August of last year, and subsequently published in the September, 1932, issue of THE JOURNAL.

Congratulations, Messrs. Warner and Prescott!

NEW STANDARDS AND REVISIONS ADOPTED

IMPORTANT revisions and new specifications were approved at a regular meeting of the Standards Committee held Tuesday morning, Jan. 24, at which George L. McCain presided in the absence of Chairman A. Boor due to illness. The nine Divisions that submitted reports were the Aircraft, Ball and Roller Bearings, Electrical Equipment, Iron and Steel, Lighting, Lubricants, Motorcoach and Motor-Truck, Non-Ferrous Metal and Screw-Threads.

Among the more important new standards approved are Thrust Bearings for Steering-Knuckles, including both the ball and roller types. Three subjects were approved for American Standard under the procedure of the American Standards Association; namely, Large Sizes of Angular Contact Bearings, Adapter-Sleeve Bearings and the Conversion Factor 25.4 mm., equal to 1 in. The last was approved for general industrial conversion but not for scientific or extremely accurate work, for which the more precise factor, 25.40005, should be used.

The Screw-Threads Division submitted a new standard for Cap or Acorn Nuts that should result in savings to both manufacturers and users.

Specifications Revised

Among the more important revised specifications is that for Automotive Insulated Cable that was prepared by a committee of manufacturers and users. The Lubricants Division continued the Free-Wheeling Transmission Lubricant Viscosity Numbers for publication in the 1933 S.A.E. HANDBOOK. The Motorcoach and Motor-Truck Division submitted a new specification for light and heavy-duty Tractor-Trailer Pintle Eyes that is in accord with the practice now generally followed.

Among the important revisions submitted by the Non-Ferrous Metals Division for the wrought-aluminum and cast-brass and bronze alloys is a new specification for Red Brass Sheet intended primarily for automobile radiators and lamp shells.

The report of the Lighting Division on a revised specification for Laboratory Tests of Automobile Head-Lamps was withdrawn until such time as it is also approved by the Illuminating Engineering Society, which has cooperated with the S.A.E. for a number of years in the development of headlighting specifications.

The reports of the Divisions as passed upon by the Standards Committee were approved by the Council at its meeting immediately following and ordered to publication in accordance with the new Standards Committee Regulations adopted last year.

VICE-PRESIDENTS FOR 1933

CLARENCE M. YOUNG (Aircraft Engineering)—A. V. D. WILLGOOS (Aircraft-Engine Engineering)—HARTE COOKE (Diesel-Engine Engineering)

M. C. HORINE (Motorcoach and Motor-Truck Engineering)—J. M. CRAWFORD (Passenger-Car Engineering)

FRED W. CEDERLEAF (Production Engineering)—ROY F. ANDERSON (Passenger-Car-Body Engineering)—J. F. WINCHESTER (Transportation and Maintenance Engineering)

COUNCILORS FOR 1933

W. T. FISHLEIGH (1933-1934)—G. W. LEWIS (1933-1934)—W. G. WALL (1933-1934)

S. O. WHITE (1932-1933)—R. E. WILSON (1932-1933)—H. T. WOOLSON (1932-1933)

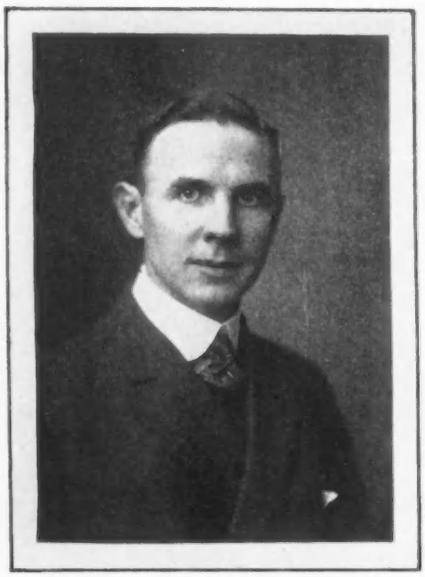
VINCENT BENDIX (Past President) DAVID BEECROFT (Treasurer)—A. J. SCAIFE (Past President)

THREE WALTS SETTLE STREAMLINING

Fishleigh, Lay and Keys Stage Elaborate Demonstration of Advanced Ideas

PROBABLY the best-organized session of the Annual Meeting was the Streamlining Session, which was carried to great heights under the generalship of Walter C. Keys, with Prof. Walter E. Lay and Walter Fishleigh as speakers. Many hours and considerable thought and energy had been spent in preparation by these three men, and the results showed it. In reality, the session was simultaneous, the addresses being presented in the Crystal Room, while Professor Lay's "envelope" car was being examined by hundreds of interested persons who came to the parking place near the hotel where the job was displayed for inspection. Some 300 members and guests attended the session.

Professor Lay reviewed the fundamentals of the streamlining problem and presented scores of interesting results of University of Michigan wind-tunnel tests on various car models. Walter Fishleigh, in characteristic style, offered and won the case against super-standardization, "the price of which is progress."



W. T. FISHLEIGH

Drag Measured with Envelope Body

Of chief immediate interest and novelty in the paper by Professor Lay and Messrs. Holton and Patterson was the unique "floating envelope" method of measuring air resistance of box-shaped bodies having square and rounded edges and corners. This method was evolved for tests on the road. As described, a dummy body of wood framing, pressed-wood panels and doped fabric is mounted "envelope" is mounted on rollers on the chassis frame so that it has a longitudinal motion of several inches. It is attached by a wire to a drawbar dynamometer on the rear of the chassis which measures the wind resistance on the envelope as and built around a coupé body, and this the car is driven at different speeds in still air.

The various prior methods of measuring drag of small-scale models in wind-tunnels and of full-scale cars in coasting tests on the road were described and analyses given. The authors reviewed tests with 22 models of various shapes at the laboratory of the University of Michigan, giving data on the results obtained and explaining how the results were worked out. Finally, the test results on models in the wind-tunnel were compared with results obtained on the road with full-scale models.

Among conclusions reached were that full advantage of streamlining cannot be obtained without improving the transmission to provide sufficient "activity" of the car at the lower speeds, and that fuel economy can be greatly increased by correct choice of gear ratios. Seven constructive suggestions were offered to car builders for increasing the speed and reducing the operating cost of automobiles.

Interesting bits of discussion were presented by Prof. Peter Altman, of the University of Detroit, and Herbert Winter, of Detroit, who said that Altman's wind-tunnel results apparently did not check with those of Professor Lay and he wondered why. Mr. Winter explained his special body design having a duct for removing the boundary layer by suction.

Standardization has assumed tremendous importance; in production, service and engineering. It is at once the strength of the automotive industry and its weakness, according to Walter T. Fishleigh. S.A.E. Standards, whereby interchangeability is facilitated, numbers of sizes reduced, quality of material maintained and costs lessened, are in continual use daily by every automotive engineer, production man and parts manufacturer.

But standardization in the American automotive industry has not stopped here, at its best and in its strength, the author said. It has gone out into a fog of "super-standardization" which threatens not only to obscure the character of individual manufacturers themselves but to block successful progress in the industry as a whole. The purpose of the paper was to call attention to several present-day conceptions which, consciously or unconsciously, have become enveloped in this fog of super-standardization and which would be very much better otherwise.

Some of the major points were considered under the headings: High Speed Alters Fundamental Considerations, Radical Improvements Logical, Super-Standardized Fallacies, Streamlining and Rear Engine-Installation, and Tear-Drop Cars. The paper ended with an interesting graphical picture of the composite operating advantages of the streamlined tear-drop car over those of a conventional sedan.

PROF. W. E. LAY

TIRES, TRANSMISSIONS AND CLUTCHES

Low-Pressure Tires and Automatic Transmissions Eminently Acceptable Features of Car Design

W. C. KEYS

A MOST interesting Chassis Session was held on Wednesday afternoon. The first paper, by Athel Denham, was on The Future for Low-Pressure Balloon Tires. The author pointed out that the public likes the super-balloon tire and that car engineers, in increasing numbers, are acknowledging the improvement in riding qualities obtainable. However, it is evident that the use of these tires requires a redesign of the entire steering apparatus of an automobile.

Mr. Denham finds the super-balloons noisier but no more subject to blow-outs than conventional tires. He thinks the statements as to their non-skidding properties have been overdrawn.

B. J. Lemon stressed the point that the super-balloons give far better traction in snow, mud and sand, and commented further that it was regrettable that they were first tried out on the public instead of being first engineered into the design of the car.

J. E. Hale commented that the cost of super-balloons would be about 25 per cent greater for a double oversize; also that each of the first three oversizes would permit of a drop of 3 to 4 lb. in air pressure.

F. W. Davis emphasized the inadequacy of conventional steering-gears to meet the needs of super-balloon tires and outlined the characteristics of a power steering equipment that he believes will giver easier and safer control with super-balloons than is obtainable with present steering-gears and balloon tires.

Automatic Transmissions

Walter Keys' paper gave an outline of previous transmission constructions such as friction, hydraulic and electric drives. He then described the Salerni "fluid flywheel," the Tyler automatic gearshift and the Banker planetary all-mechanical automatic-shift transmissions. He showed that the trend of the average cruising speed of the public has increased from about 15 m.p.h. in 1902 to about 45 m.p.h. in 1932 and showed that this trend forecasts 70 m.p.h. in 1942 and 100 m.p.h. in 1952, provided the highways are developed to permit of sustaining the high speeds that are even now possible with modern automobiles. He then explored the possible advantages of driving with wide-open throttle using an automatically changing, infinite-ratio transmission and concluded by stating that he believes automatic transmissions will soon appear as standard equipment.

E. E. WEMP

A. F. DENHAM

Lyle Snell pointed out that a better performance than is obtainable with the Otto-cycle engine is desirable. P. J. Kent mentioned for the edification of hopeful inventors that no automatic transmission can provide increased torque without having a reaction point between its driving and driven ends. He also stated that he expected that the transmission problem would ultimately be solved by electromagnetic means. T. C. Smith expressed the opinion that any future transmission must be designed to permit of easy servicing in the field.

What Next in Clutches?

Four past and present types of clutch used in motor-vehicles were listed by E. E. Wemp, in his paper on the new A.B.C. in clutch design, and the purpose of his paper, he said, was to attempt to feel the pulse of the industry with a view to ascertaining what may be expected as the next stage of clutch development. Comparing a present clutch with one of the same size of four years ago, he said the present one has 36 per cent greater capacity in pounds-foot torque. This has been accomplished by three major design improvements, which were specified and described in detail. Automatic clutches were defined as those which inherently are always released at idling speed and automatically engage when

the engine is speeded up. Two types of such clutch—the centrifugal and the fluid flywheel—were discussed in detail. The concluding portion of the paper was devoted to consideration of control of the conventional clutch through an external agency, such as some form of vacuum control.

In response to questions from Cecil Taylor as to whether 12 per cent manganese steel had been tried for clutch pressure-plates, Mr. Wemp stated that his experience had been confined to the high-tensile irons and nickel-chromium irons. He answered another query regarding the towing or pushing of a car (equipped with the centrifugal clutch) to start the engine. This is done by first shifting to high gear; then with clutch pedal held forward, allowing the car to reach about 15 m.p.h. The pedal is then allowed to come back, which, for 3 or 4 sec., turns the engine over at sufficient speed to start it.

This session was convened as a stated business session of the Passenger-Car Activity for the purpose of electing a Nominating Committee charged with the duty of choosing the Vice-President of the Activity for the year 1934. W. T. Fishleigh, G. B. Allen, G. L. McCain and O. A. Parker were elected members of this Committee, with K. M. Wise as alternate.

VIEW STREAMLINING AERODYNAMICS

Members, Visiting University of Detroit Laboratories, Witness Demonstration

UNDER the genial guidance of Prof. Peter Altman, some 70 members of the Society spent a most interesting afternoon on Monday, Jan. 23, at the University of Detroit laboratories, obtaining a picture that showed how correct streamlining can aid the present automobile.

Dean Frund, of the College of Engineering, made a brief address of welcome when the group arrived at the laboratories. Members were then shown motion pictures of actual development work along aerodynamic lines which the automobile companies are undertaking at present.

The first demonstration, made in one of the smaller wind-tunnels, illustrated the yawing effect of a true streamlined section.

A second wind-tunnel illustrated graphically the variation in resistance of bodies of the same projected area but dissimilar in shape, showing that the resistance of a cylinder is 10 times greater than that of a streamlined section of the same projected area.

Air-Flow Shown in Large Tunnel

The large wind-tunnel with a maximum air-speed of more than 100 m.p.h. proved to be the most interesting exhibit, for here Professor Higgins had a quarter-size model of one of the recent cars mounted on wires and, with the use of smoke and a ribbon, demonstrated clearly the effects of streamlining certain parts of the car to reduce materially the turbulence and so reduce the air resistance.

The actual air-flow could be seen for each variation, and the group of members later inspected the finely balanced and electrically operated sets of scales that are used to measure the actual resistance of these model cars under various conditions. This wind-tunnel is used also to test scale models of airplanes as well as various forms of airfoil.

Strut-testing machines, airplane engines and many other interesting exhibits held the attention of the visitors until nearly supper time and all went away feeling that they had spent an exceedingly profitable and instructive afternoon.

George L. McCain, of the Chrysler Corp., is to be congratulated upon having arranged the trip, and his company deserves thanks for having furnished such excellent and up-to-the-minute means of transportation. Professor Altman and his associates at the University received many expressions of appreciation of their work and hospitality in staging the demonstration.

FRONT-WHEEL ALIGNMENT WORK EFFECTIVE

THE WORK of the Front-Wheel-Alignment Subcommittee is believed to have accomplished worthwhile, if not spectacular, results. According to a report made at a meeting of the Subcommittee on Jan. 24, better car design, improved methods and measuring instruments, both in the factory and in the field, and the constant pressure of sane engineering opinion on such bad field practices as hot bending are having beneficial effects. Car makers' engineering and service divisions are setting up procedure and coordinating methods in the field with those used in their factories and are training field representatives in the proper application of established methods. Uptodate car-alignment specifications, with details as to how taken, will be distributed through such outlets as to become widely available for independently operated alignment service-stations.

The Subcommittee will expand its representation and continue its work with both the car and the instrument makers during the introduction of the super-balloon tire, with the object of consolidating gains resulting from past experience and, if possible, anticipating future problems.

TO EXTEND RIDING-QUALITIES WORK

THE Riding-Comfort Research Subcommittee considered in detail a progress report rendered by Dr. F. A. Moss covering his experimental research for the Committee throughout the last year and also reviewed the steps in the development of the research program covering the last four years as summarized in Dr. Moss's paper presented at the Riding-Qualities Session on Thursday.

In continuation of the work, Dr. Moss was authorized to proceed with tests to determine the riding characteristics of various cushions and tires, including the range of oversize low-pressure tires.

A subcommittee was elected to negotiate with the manufacturers of the wabblemeter, looking toward an expansion of its production and distribution, not only to the automotive industry for determination of riding-quality, but also to manufacturers in general for measurement of industrial fatigue and for clinical use in hospitals where accurate determination of nervous exhaustion is the objective.

In response to a proposal from Dr. Donald A. Liard, director of the Psychological Laboratory at Hamilton, N. Y., tentative arrangements were made for exhibition and use of the instrument at the Chicago Century of Progress Exposition in the scientific study of the diurnal course of fatigue. The anticipated stream of visitors through the fair should make possible a tremendous sampling of human records. These data obtained under the direction of Dr. Liard, in addition to their scientific value, are expected to have a wide appeal to the public through the press. Materialization of this plan should bring knowledge of the wabblemeter and the Society's research work to a portion of the public which numbers many more than the actual visitors to the exhibit.

CAN WE GET AND MEASURE RIDING COMFORT?

Moss Coordinates the Measurements of Riding-Qualities—Kindl Discusses Shock-Absorbers

REFERRING to the work of Dr. Fred A. Moss, of George Washington University, as the foundation of all the riding-qualities investigations conducted by the Society during the last four years, and expressing the hope that funds will be forthcoming which will make possible the continuance of further work in this field, Chairman F. F. Chandler, who presided at the Riding-Qualities Session, introduced, as the first speaker at the session, Dr. Moss, who presented his final report on the Society's program of riding-qualities research, the word "final" to be understood in the sense of marking the completion of the work as outlined to date.

After reviewing the research work done since the summer of 1929 along the lines of measuring bodily fatigue produced by an automobile ride, Dr. Moss stated the requirements of a good objective measuring instrument. He dismissed the subjective impressions of rider subjects as of little value because of their unreliability. Instruments used in the investigation, including the wabblemeter developed by the Riding-Comfort Subcommittee, the visiometer and a reaction-time instrument, were described and résumé was given of the results of a series of tests made on five subjects riding in three current makes of low-priced sedan during the summer of 1932. Data from wabblemeter tests and tests of reaction time and carbon-dioxide combining power of the blood rated the three cars in the same order as regards riding comfort.

At the conclusion of Dr. Moss's presentation, questions were asked and comments were made by a number of members, including W. C. Keys, Tore Franzen, Ferdinand Jehle, Neil MacCoull and Herbert Chase.

Before proceeding to the next paper, the following motion, which was offered by W. C. Keys as expressing the sense of the meeting, was unanimously carried:

We enthusiastically and wholly approve the splendid scientific work which Dr. Moss has carried through to a successful completion. We recommend to the Council that a suitable certificate expressing the Society's approval and appreciation of his efforts be prepared and presented to Dr. Moss.

DR. F. A. Moss

CARL KINDL

Shock-Absorber Development Reviewed

Shock-absorbers, an important item of design having a close relation to the question of riding comfort, received the attention of the audience of more than 200, during the second half of the session, a paper on the subject of inertia-control shock-absorbers being ably presented by Carl A. Kindl, of the Delco Products Corp.

Mr. Kindl pointed out that, since hydraulic shock-absorbers were introduced as standard equipment about five years ago, interest in the riding-qualities of cars has been intense and many improvements have been made in shock-absorbers. He divided hydraulic absorbers into the piston and the vane types, mentioned their respective advantages and disadvantages, and then discussed various kinds of action control. An instrument was needed, he said, that would distinguish between body movements and axle movements, so that suitable independent controls could be obtained. This led to the development of the inertia-controlled shock-absorber. Mr. Kindl then illustrated and described the construction and operation of such an instrument and presented curves of body and axle oscillations to show the effect of the device as compared with that of the conventional shock-absorber. He also showed special equipment designed for

testing the inertia absorber and for setting the inertia valve.

The discussion, in which Herbert Chase, Tore Franzen, S. P. Hess, W. C. Keys, L. K. Snell and others participated, stressed the idea that, in the matter of securing greater riding-comfort, the car engineer cannot expect the shock-absorber man to do his job for him but must analyze and attack the problem for himself, paying particular attention to the matter of suspension.

SPRINGS AND FOREIGN-CAR DESIGN TREATED

Body-Session Authors Outline Seat Comfort and Foreign versus American-Body Design

THE business meeting of the Passenger-Car-Body Activity was held at the beginning of the Body Session on Jan. 25, the following men being elected as members and alternates of the Passenger-Car-Body Nominating-Committee:

Nominating Committee—Alexander Carlson, Leo L. Williams, James Levy and Amos E. Northup.

Alternates—Rudolph I. Schonitzer and I. L. Carron.

About 50 persons attended the technical session, of which J. W. Votypka was Chairman. Two papers were presented; namely, Cushion-Spring Comfort, by F. R. Atkinson, of the Atkinson Spring Co., Hamburg, N. Y.; and Results Gained from Foreign Designs, by A. E. Northup, chief body designer for the Murray Corp. of America, Detroit.

Comfortable Seat Cushions

Buyers today take mechanical performance for granted, according to Mr. Atkinson; but they will not buy an ugly car. The modern automobile is therefore "styled" merchandise. The three vital points governing automobile-body design are utility, design of beauty around the utility and *comfort*. Extreme cushioned comfort with good visibility from the car and all that this implies will be the next great public demand; the type that will carry the passenger many miles and for many hours with extreme enjoyment and virtually no fatigue. Therefore, cushion-spring builders may well become contributors to car salability. The importance of suitable cushion-seat springs in obtaining riding comfort was stressed and chassis designers were told of difficulties that hamper spring manufacturers in providing comfort.

Few cars in the foreign automobile shows could be used for production design, as viewed by the American designer, Mr. Northup stated. It is only when the designer studies details of these cars that he discovers wherein their value lies for him. Most American cars are built by production methods, while foreign cars are largely custom-built. This difference has far-reaching results.

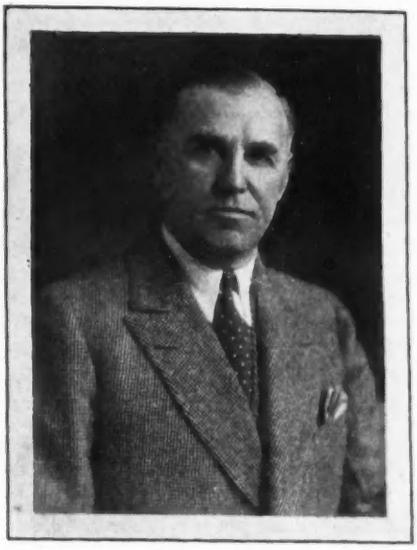
AMOS NORTHUP

(1) Principles employed in custom manufacture usually are not adaptable to production.

(2) Designs can be more radical for individuals than for the general public.

(3) American investment is so much larger that more depends on the success of every design.

(4) If any imperfection is found in the job, to remedy one or a few cars is easy, but that is not so with quantity production. After the job goes into production, to change it is difficult.



F. R. ATKINSON

In view of the foregoing facts, the entire foreign car and the ideas it embodies obviously cannot be used in a practical way for American designs. As to where their real influence is of benefit, the most outstanding fact is the *variety* of styles or types presented by each detail. In America, when some new detail is presented to the public *and accepted*, many other designers imitate it in their next creation and America is accused of having all its cars look alike. In Europe, perhaps because of pride in individuality, or perhaps because builders' design patents are binding, one does not find a certain type of any detail in vogue. Instead, a variety of types on all the current cars are in evidence. The author then considered in detail how foreign specific items of design have influenced American designs.

STABILITY FACTOR OF CRANKCASE OIL

DISCUSSION at the meeting of the Research Committee on Jan. 26, brought forth another tribute to the far-reaching effects of

the mutual understanding and spirit of cooperation developed between the automotive and petroleum industries through the medium of the Cooperative Fuel Research, which the Society has sponsored with the cooperation of the American Petroleum Institute, the National Automobile Chamber of Commerce and the Bureau of Standards during the last decade.

The report made by H. L. Horning, Chairman of a special subcommittee appointed last June to consider the need for studying the changes that occur in crankcase oils in service, with the object of developing significant test methods for oxidation and gumming characteristics of the lubricants, was the occasion for contrasting the situation as it obtains today with the misunderstanding and antagonism that existed prior to the inauguration of this cooperative undertaking.

Recommendation Enthusiastically Received

Mr. Horning's subcommittee, which met in New York City on Jan. 13 with 100 per cent attendance, recommended to the main Committee that a research group be formed to explore the field of service changes in crankcase oils to determine the present state of knowledge of the subject with a view toward establishing a suitable stability factor for crankcase oils.

The enthusiasm accorded this recommendation, and the indication of willingness on the part of individual companies to contribute data already obtained, inspired Mr. Horning to speak in the highest terms of commendation of the petroleum industry for its unselfish spirit of cooperation, as evidenced by the extensive commercial sacrifice generously made by the oil industry in the interest of a universally satisfactory method for evaluating the knock tendency of motor fuels.

The Research Committee also considered and approved reports of Subcommittees and formulated and approved plans for the Society's research work during 1933.

Dr. O. C. Bridgeman presented for the information of the Committee additional reports on the lubrication activities at the Bureau of Standards aside from the Committee's projects.

WHO SAYS DESIGNERS ARE SATISFIED?

Car Designers Receive and Return Pokes—Aluminum Cylinder-Head Merits Enumerated

THE Passenger-Car Session, with an attendance of more than 200, resolved itself into a two-round fight. In the first round, "pertinent pokes at satisfied designers" were followed by good-natured retaliation from the pokees. In the second round, the advocates of aluminum cylinder-heads became involved in a verbal battle with their adversaries, and for an appreciable length of time the air was rent by cries of "not so hot," "much too hot," and other combustible assertions and contradictions.

In introducing Herbert Chase, whose subject was Pertinent Pokes for Satisfied Designers, Chairman Alex Taub disclaimed all knowledge of the existence of any satisfied designers, and Mr. Chase, in agreeing that there probably is no such animal, said that in delivering his well-meant pokes he was aiming them quite as much at the "bosses" of designers as at the designers themselves.

How Cars Could Be Improved

The pokes were made with a button-tipped foil by Mr. Chase, who suggested in his paper that the engineer draw up a list of features he conceives of as embodied in an ideal design and then try to induce his company to adopt first one and then another.

F. F. KISHLINE

HERBERT CHASE

As an indication of what he thinks such a list should contain, Mr. Chase reiterated complaint against the uncomfortableness, weight, complexity, lack of safety and refinements and the hardness-to-service of the present standardized type of car. He elaborated on these and pointed to ways in which he thinks they can be remedied, as by correcting "low-down" engineering, using three-point frame suspension, utilizing more area for passenger and luggage space, placing the engine at the rear or under the floor, eliminating running-boards and fenders, streamlining, providing better visibility, simplifying controls and the like through a considerable list. His paper was a constructive criticism of the type of car so widely praised today for the advancement made in engineering last year.

T. J. Litle, J. A. Anglada and others took part in the lively discussion following Mr. Chase's presentation, and debated most on the points covered by him.

Gains from Aluminum Heads

The second part of the program consisted of a paper on Aluminum Cylinder-Heads by F. F. Kishline, of Graham-Paige Motors Corp. Recommending an increase in the compression and the ex-

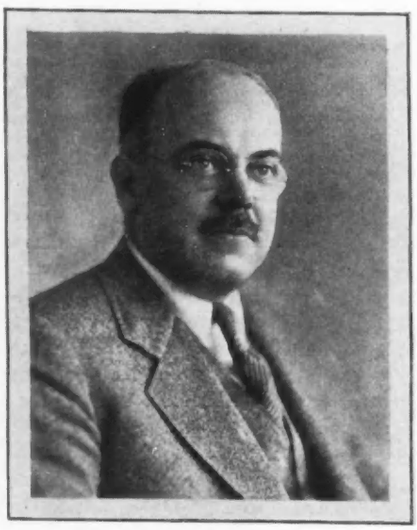
pansion ratios of the engine as a logical means for the engineer to use in creating better transportation, Mr. Kishline endeavored to show that aluminum as a cylinder-head material has been found valuable in making possible a considerable increase in the compression and the expansion ratio. He quoted gains in performance, taking figures based upon observed dynamometer performance of the same engines under identical conditions of air, water and mixture temperatures and with the same manifold sizes, carbureter sizes, valve sizes and timing, with nothing changed except the heads.

In addition to the performance gains, Mr. Kishline claimed the following advantages for engines having aluminum cylinder-heads: better idling, better starting, lower exhaust-gas temperature, slightly better cooling with given radiator capacity, somewhat decreased connecting-rod-bearing loads at high engine-speeds, less ill effects from carbon accumulation, smoothness at least equal to that had with iron with one ratio lower, and an increased feeling of responsiveness at speeds above 35 m.p.h.

Among those who discussed, pro and con, the advantages claimed by Mr. Kishline were R. N. Janeway, T. J. Litle, L. P. Saunders, Ferdinand Jehle, G. C. Brown and Brooks Walker.

DIVERSIFIED PROGRAM AT STUDENT SESSION

Hutchinson Decries Unfair Regulation of Motor-Vehicles—Rentschler Tells about Radium Energy



B. E. Hutchinson

AN AUDIENCE of more than 700, comprising a number of S.A.E. members but made up largely of college and university students, assembled in the ballroom of the Book-Cadillac on Monday evening, Jan. 23, to listen to a program that was pleasingly uniform with respect to its high quality and splendidly varied as to its content.

H. T. Woolson, chief engineer of the Chrysler Corp. and Chairman of the Detroit Section Student Activity, after welcoming the students, called upon the newly-elected President of the Society, Dr. H. C. Dickinson, to say a few words.

Dr. Dickinson spoke of the engineering fraternity as being outstanding among the professions as the creative group, and he advanced the idea that the engineer of the future will need to be a more versatile person than the engineer of the past.

A Financial Leader Speaks

Proceeding to the program prepared by the Student Activity for this meeting, which he designated as the climax of the several student meetings held during the year, Chairman Woolson introduced to the audience the vice-president and treasurer of the Chrysler Corp. and president of the Plymouth Motor Corp.—B. E. Hutchinson.

Tracing the development of transportation and showing that each improvement in transportation facilities had encountered opposition from the form immediately preceding it, Mr. Hutchinson said that the competition between the two essential agencies of transportation, the railroad and the motor-vehicle, has become an issue of major economic importance. If it is approached on the basis of sound economic policy, he said, the ultimate solution of this problem will not materially interfere with the continuing usefulness of either of these transportation agencies.

Stating that regulation of transportation, as we know it today, was undertaken when the railroads had a practical monopoly of transportation service, and pointing out that neither railroads nor motor-vehicles have any monopoly at the present time, Mr. Hutchinson asserted that now no need for regulation of motor-vehicles exists except in regard to matters of safety and adequate taxation; in other words, whatever regulation is necessary should be altogether social in its character and not economic.

A Distinguished Scientist Demonstrates

After thanking Mr. Hutchinson for his clear and forceful exposition of a vital problem, Chairman Woolson introduced as the next speaker the distinguished scientist, Dr. Harvey C. Rentschler, director of research, Westinghouse Lamp Co.

Dr. Rentschler presented highly important practical applications of certain regions of the electromagnetic spectrum by nine demonstrations. He stated that energy transference from light and heat radiation from the sun is by electromagnetic waves and that vibration frequency determines the pitch of sound and the color of light. The color type of radiation is best distinguished as wave length. An octave represents two radiations; one has a wave length one-half that of the other.

In Dr. E. E. Free's recent article in the *North American Review* on Who Are the Greatest in Science? Dr. Rentschler was mentioned. Dr. Free, in that

Dr. Harvey C. Rentschler

article, picked out the 10 key men in the wizardry of research, assigning a place to Dr. Rentschler, whom he termed "the best tamer and user of photoelectric cells that the world of physics has yet produced".

TESTING EQUIPMENT AND FUEL PROPERTIES

Their Relation to High-Speed Diesel-Engine Development and Successful Operation

E. T. Vincent

AS USUAL, the attendance and interest at the Diesel-Engine Session ran high. The paper by E. T. Vincent on testing with the Farnboro electric indicator led to general discussion of the use and interpretation of results covering a wide variety of precision instruments employed in the development of Diesel engines.

Literature chiefly enumerating the faults of uptodate indicators has, in Mr. Vincent's opinion, driven the practical men to believe that engine indicating is not worth while because it is almost impossible to obtain engine-cylinder diagrams in a cheap, quick and reasonably accurate way. He argued that indicators are needed in oil-engine development, discussed indicator types and their application, and described the operation of the Farnboro electric indicator, stating six advantages it possesses.

Max Hofmann's paper, Fuels for High-Speed Oil Engines, served as a fitting sequel to papers presented in former meetings by A. W. Pope and J. A. Murdock, of the same organization, and G. D. Boerlage and J. J. Broeze, from the renowned engine-research laboratory of the Bataafsche Petroleum Co., at Delft, Holland. It indicates that the time is not far distant when cooperative research may be undertaken to establish a standard method of test for ignition and lag characteristics of Diesel fuel oils.

Stating that the time has come when Diesel-engine designers and fuel producers must cooperate to establish a standard rating for oil-engine fuels, Mr. Hofmann said that this rating should enable the engineer to judge whether a certain fuel will burn without objectionable knock in a given type of engine; that is, it should be similar to the octane rating for carbureter fuels. He discussed in detail the present status of Diesel-engine fuel research, emphasized its practical value to the engine designer and operator and suggested a way leading to ultimate standardization of ratings for such fuels. In conclusion, Mr. Hofmann suggested that, when a method for knock rating has been established, a standard be set for Diesel-fuel specifications, covering knock rating, gravity, viscosity, pour point, Conradson carbon-test, and sulphur content.

In conjunction with this Session, the annual business meeting of the Activity was held, during which A. W. Pope, A. L. Beall, Charles Guernsey, Frank C. Mock, A. J. Poole and A. A. Lyman were elected to serve as the Activity's Nominating Committee and alternates for the coming administrative year.

NEW E-P LUBRICANT TESTER

A NEW lubricant tester for determining the load-carrying capacity of extreme-pressure lubricants at the Bureau of Standards was exhibited

Max Hofmann

at the Lubricants Research Subcommittee meeting on Jan. 23.

This machine was developed at the Bureau of Standards as a part of the Subcommittee's cooperative research investigation on E-P lubricants, financed by interested petroleum and automotive companies, in progress at the Bureau. In the course of this investigation, comparative tests were made on a number of representative lubricants using several machines operated under a wide range of conditions. The results indicate that none of these machines rates all types of lubricant in the order of their service performance. While all of the machines have many favorable characteristics, each is deficient in that the area of contact between the rubbing surfaces changes during the test run, the change being different for various lubricants and for various operating conditions.

In the new machine, no change occurs in the area of contact between the rubbing surfaces during the test run. This is accomplished by using two rolls, both of which rotate, so that the apparatus consists essentially of two toothless gears rubbing on each other. Any wear that occurs during the run will be uniform around the circumference of the rolls. By suitable gearing, any kind of motion from pure rolling to pure sliding can be obtained, with various intermediate degrees of combined rolling and sliding motion. With this machine, all of the variables encountered with gears can be reproduced in the laboratory.

With the development of a satisfac-

tory design to test the lubricating quality of E-P lubricants, it is expected that the evaluation of the various types will proceed rapidly to the stage of correlation with service conditions.

The Lubricants Research Subcommittee recommended that the cooperative investigation be continued and that the Bureau proceed with an investigation of the load-carrying capacity of the representative lubricants as determined on the new machine operated under the type of conditions encountered in service. Emphasis was placed on the necessity for accumulating service data on E-P lubricants, and many organizations in the automotive and petroleum industries are cooperating in acquiring this information. After an apparatus and procedure have been developed for measuring load-carrying capacity, the Subcommittee will undertake an investigation of the other properties of these lubricants, such as wear and stability.

FUELS AND LUBRICANTS SESSION

Lively Discussion Follows Each of Four Informative and Authoritative Papers

THE FIRST meeting of the new Fuels and Lubricants Activity was held on Thursday afternoon, Jan. 26. J. B. Macauley, of the Chrysler Corp., was Chairman. The first paper, dealing with a vapor-lock investigation at the Bureau of Standards, was presented by O. C. Bridgeman.

The essential features of this paper are that, from vapor-lock data obtained from the road tests and from vapor-pressure measurements on the fuels used, it is possible to evaluate the vapor-handling capacities of the 46 cars investigated under the operating conditions studied. Since these values for vapor-handling capacities are characteristic of the fuel system and are independent of the specific fuel used in the vapor-lock tests, it is feasible to evaluate with considerable accuracy the permissible vapor pressures for use in these cars, not only for any given type of fuel of known vapor pressure characteristics but also for any given operating conditions. Thus, under the worst operating conditions with the type of fuel which vapor locks the most readily, the work to date indicates that the permissible vapor pressure for operation at an atmospheric temperature of 100 deg. fahr. is 8 lb. per sq. in. while for operation at 75 deg. fahr. the permissible vapor pressure can be as high as 12 lb. per sq. in.

It was stated that the work during the winter months on the continuation of this investigation is being confined largely to a study of the effect of atmospheric temperature on fuel-line temperatures in a number of representative cars. As soon as the warm weather comes again, vapor-lock road-tests will be resumed at the Bureau of Standards with the object of investigating differences in vapor-locking tendencies with different types of fuel.

In the discussion, the chairman emphasized the importance of making use of the information contained in the paper when designing new models in order that the new cars will be freer from vapor-lock troubles than are those on the road at present.

Detonation Paper Presented

The report of the Detonation Subcommittee of the C.F.R. Steering Committee was presented in a paper prepared by C. B. Veal, Society of Automotive Engineers; H. W. Best, Yale University; J. M. Campbell, General Motors Research Laboratories, and W. M. Holaday, Standard Oil Co. (Ind.). This paper, entitled Correlation of C.F.R. Laboratory Knock Ratings with Behavior of Motor Fuels in Service, was summarized at the session by H. W. Best.

H. W. Best

In this summary Mr. Best referred to the Uniontown road tests on the basis of which it was possible to rate the various types of fuels now available on the basis of their actual service performance. On analysis of these data it was found that the order of rating differed somewhat from that given by the C.F.R. engine operated according to the procedure being used at that time. To obtain a better agreement between the laboratory results and service performance, the various cooperating laboratories sent representatives to Waukesha, Wis., to develop such a procedure. This work was so successful that, with only minor modifications in the test procedure such as changes in speed and mixture temperature, it was possible to correlate the road ratings with the laboratory rating according to the new method with a high degree of precision.

In discussion, H. K. Cummings, of the Bureau of Standards, emphasized the desirability of obtaining further road-test data on a greater variety of cars and he referred to a simple method for simulating hill-climbing tests on level ground by use of a traction dynamometer. Mr. Holaday and Mr. Best, co-authors of the paper, presented the discussion of their own paper covering an analysis of the experimental data on the basis of design factors and operating variables. A. E. Becker, of the Standard Oil Development Co., presented a somewhat similar discussion on the effect of design factors on tendency to detonate.

Extreme-Pressure Lubricants

A paper entitled The Load-Carrying Capacity of Extreme Pressure Lubricants was presented by S. A. McKee. The co-authors were E. A. Harrington and T. R. McKee. It covered a report on the investigation of these types of lubricants

H. S. White

being carried on at the Bureau of Standards under the auspices of the S.A.E. Lubricants Research Subcommittee. It was pointed out that the various machines studied do not rate the lubricants in the same order when operated according to the recommendation of the manufacturers of these machines.

It also was pointed out that it was not found possible to choose sets of operating conditions for these machines which would rate the lubricants in the same order.

In general, the load-carrying capacity was found to decrease with increase in oil temperatures and also with increase in speed. On the basis of the information obtained in this preliminary investigation, a machine was designed and constructed at the Bureau of Standards with which the ratio of applied load to actual pressure remains constant throughout the entire test run. This machine had the additional feature of permitting a study, not only of the effect of temperature, speed and metal composition on load carrying capacity but also a study of the effect of various degrees of combined rolling and gliding motion.

J. O. Almen, of the General Motors Corp. Research Laboratories, stressed the difficulty of obtaining a laboratory machine which will reproduce service conditions and placed considerable emphasis on the necessity for obtaining extensive service data on extreme-pressure lubricants.

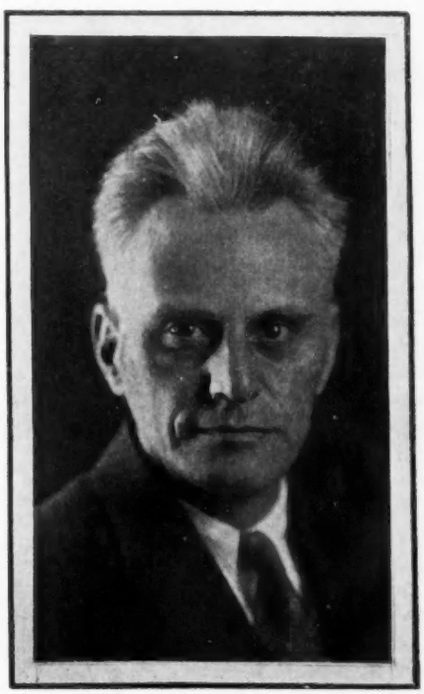
The last paper in the session, entitled The Effect of Load on Friction in the Region of Thin-Film Lubrication, was presented informally by O. C. Bridgeman, of the Bureau of Standards. This paper summarized the work that has been going on at the bureau of investigations in the thin-film region and presented some new data obtained with the Timken machine on a variety of oils, some of which were extreme-pressure lubricants.

It was pointed out that the effects of temperature on friction may be accounted for on the basis of changes in the viscosity oil and that, by plotting the coefficient of friction values against the product of the speed and viscosity, a single curve is obtained for each lubricant independent of applied load.

In the discussion, R. N. Janeway, of the Chrysler Corp., presented a very interesting set of data on friction in the boundary region between thin and thick-film lubrication obtained in actual engine bearings at high speeds and loads. This stimulated a very lively discussion by several persons on friction in journal bearings.

Formation of New Activity

At the completion of the technical session, Councilor R. E. Wilson announced that the S.A.E. Council had approved the formation of a new activity to be called the Fuels and Lubricants Activity. Dr.



S. A. McKee

O. C. Bridgeman

A. E. Becker, of the Standard Oil Development Co., was appointed to be the Vice-President.

This new Activity thereupon convened for a Business Session, and the following Nominating Committee was appointed to nominate a Vice-President for 1934:

Nominating Committee.—H. C. Mougey, R. E. Wilkin, C. R. Noll and J. C. Geniesse, members; B. B. Mears and Sydney Bevin, alternates.

MEMBERSHIP PLANS WELL FORMULATED

ACCORDING to reports that were made to Sections Committee Chairman Ralph R. Teetor, a diversified and successful program of activities is being pushed in various Section territories. Members who attended the Sections Committee meeting in Detroit on Jan. 23 agreed that the suggestions that were offered would form the basis of an improved membership program. Many of the ideas expressed had been discussed earlier in the day by the Membership Committee, with Chairman Alex Taub and Chairman-Elect F. K. Glynn presiding. The upshot of both Committee sessions was a better understanding of membership conditions and a fresh start toward improvement along these lines.

Among the routine matters of Section procedure that were discussed by Mr.

(*Concluded on p. 34*)

HIGH LIGHTS

WHAT a meeting it turned out to be! Just about the biggest from an attendance standpoint the Society ever held. Total number registered went over the 1500 mark. And when you add together the attendance totals of the various technical sessions and the big Thursday night dinner, you get the impressive figure of 3215. There's no depression in the velocity and vitality with which engineers are exchanging ideas.

* * *

LAND GRANTS to the railroads in the United States approximate the total area of Germany and Great Britain —believe it or not. Best believe it, though, because T. H. Dahl, White v-p., says it's true. It was just one of many little-known facts that he hurled at the crowd attending the Transportation Session which opened the meeting. Another was that Texas anti-truck legislation has driven 30,000 commercial vehicles from the roads and lost the State of Texas $2,500,000 revenue in six months.

* * *

WALTER LAY, University of Michigan streamline tester, not only brought to the meeting a flock of wooden models on which he had been making wind-tunnel tests, but also a Chevrolet whose entire body was enclosed in a rectangular box, the edges of which were rounded off. This queer looking test vehicle made laymen as well as engineers curious as it stood on display in front of the hotel.

* * *

NINETEEN different committees met, made progress and, in many instances, reached decisions during the four days of the Annual Meeting. Results of some of these working-group sessions are detailed elsewhere in this issue. Fuller reports on most of them will be in print a month or two hence. Action of some, such as the Nominating Committee, must remain under cover for many months to come. But vital, purposeful work was done in every instance.

* * *

DR. RENTSCHLER, Westinghouse Lamp Co. scientific wizard, came to Harry Woolson's Student Session with 60 octaves of radiant energy—and demonstrated experimentally to the 1000 students present some highly important practical applications of radiations of certain regions of the vast electromagnetic spectrum. These Detroit student sessions seem to keep getting better and better, although the very first one was an outstanding success.

* * *

Ex-PRESIDENT ARTHUR SCAIFE announced his agreement with soon-to-be-ex-President Herbert Hoover that 1932 was a tough year for anybody to be president of anything.

* * *

THE "ZN over *P"* experts reported that sometimes *P* gets into the numerator. Then, they say, everything goes haywire.

WALTER, WALTER AND WALTER—streamliners all —comprised the entire cast of characters at the Wednesday night session.

W. Keys presided; W. Fishleigh panned the engineers for going to super-standardization; and W. Lay told what wind-tunnel tests showed about streamlining possibilities.

* * *

PRESIDENT DICKINSON'S brilliant economic attack on the problems of business stabilization was so full of high lights as to dazzle. "When you discharge a $2,000 employe," he said, "you reduce the net national income by $6,000."

"The present trends of financial, business and political leadership are opposing recovery. . . . Recovery probably will take place in any case, slowly of its own accord, but rapidly if correct principles are followed. . . . The welfare of an economic unit depends just as definitely on a proper relationship between capital and business as does that of the primitive weaver or the modern factory. . . ."

But you'll just have to read the paper! It caused a real stir at Detroit.

* * *

INCIDENTALLY, here is Dr. Dickinson's "Equation of Welfare" which summarizes much of his story:

$$I = MV + (C_{E2} - C_{E1})$$

Which is readily interpreted when we know that:

I is *annual income*

M is *money*

V is *velocity of money*

and the parenthesis represents the difference between capital values at the beginning and end of the year.

* * *

THIS Annual Meeting established one new 1933 record. So far as can be learned, not a single speaker—not even Dr. Dickinson, whose paper dealt exclusively with economics—mentoned technocracy. Although one discusser of Padgett's paper in the argumentative Production Session did throw his head back and ask a bit belligerently: "Are there any Technocrats here?" Nobody responded —so no new fight was started and the meeting went on.

* * *

THE PRODUCTION Luncheon at which K. T. Keller, Dodge president, talked on Production, the Human Equation, furnished an almost perfect example of why it's worthwhile to go to S.A.E. sessions in person and not depend on reading afterward about what happened. Keller talked freely and frankly about production and human-relations problems. He spoke his mind—and he quoted intimate facts and figures to back up his statements. But he spoke thus freely only on the condition that no written report be made of much of what he said. Those who did attend came away almost unanimously of the opinion that they had taken part in one of the most significant and powerful sessions ever held. The Dodge president made history for those who were there.

J. E. PADGETT ADVOCATES SIMPLER TOOLS

Some Think Welding May Help Reduce Cost—Others Voice Differing Opinions

DISCUSSION of the paper presented by J. E. Padgett at the Production Session, printed elsewhere in this issue, turned largely about the contention that machine-tools should be simpler and cheaper. Mr. Padgett made a good case for himself but naturally found little sympathy among machine-tool manufacturers, who were well represented at the meeting. Raymond S. Perry's remarks indicated, however, that moves toward simplicity, perhaps involving more welded construction, did not seem unreasonable and that the industry is due for something new; perhaps even a new conception of basic elements that might be combined in a variety of ways to form different machine-tools. He said that the machine-tool designer often lacks background and seldom has "half the story" as to tool users' requirements.

V. P. Rumely acted as Chairman of the session. He admitted that present-day cars are good, but said that better ones are coming and that production men must not rest on their oars but be ready to produce new products when market conditions justify the tooling expense that is involved.

A written discussion submitted by C. G. Williams criticized the fixtures shown in Mr. Padgett's paper as being too slow in loading and unloading. He also contended that cast fixtures are not to be counted out, although welding sometimes presents certain very material advantages.

A stated business session of the Production Activity was convened at which a Nominating Committee was selected to nominate the Vice-President of the Activity for 1934. This Nominating Committee consists of the following: D. A. Wallace, C. E. Wilson, F. W. Cederleaf and W. W. Nichols, members; and W. H. McCoy and V. P. Rumely alternates.

J. E. PADGETT

COUNCIL RECOGNIZES NEW ACTIVITY

A. E. Becker Receives Appointment

AT THE Council's Jan. 11 meeting in New York City, approval was granted of the recommendations of the S.A.E. Motor-Vehicle Code Committee, which proposals had previously received practically unanimous approval by members of the Committee. It was the sense of the Council that the report, after being prepared in its final form by Chairman Glynn and Vice-President Horine, with a suitable background of considerations upon which the recommendations were based, should be referred to the Motor-Vehicle Conference Committee for such action as it might care to take.

Tank-Truck Standardization

Complying with a request of the American Petroleum Institute, the Council appointed M. C. Horine, B. F. Jones, W. F. Kline and A. J. Scaife to serve as members of a cooperative Subdivision of the S.A.E. Motorcoach and Motor-Truck Division of the Standards Committee, this Subdivision to cooperate with the A.P.I. Central Committee in making a study and recommendations on tank-truck standardization.

Numerous routine business matters concerning finances, membership, committee procedures and the like were transacted during a busy session.

The Detroit Sessions

On Jan. 24 and 26 the 1932 and the 1933 Councils met in joint sessions in Detroit. Routine topics were handled and the recommendations of the Standards Committee were approved as submitted.

It was decided that the Society should comply with the request of the American Standards Association by appointing a representative to cooperate in the development of a ventilation code under the procedure of the A.S.A.

Consideration was given to a suitable place for the 1933 Summer Meeting but a decision was deferred until a final report of the Meetings Committee is submitted and additional information obtained.

New Activity Recognized

After hearing a petition, signed by nearly 200 members and prospective members, the Council granted recognition of a Fuels and Lubricants Professional Activity. Dr. A. E. Becker was appointed by the Council as Vice-President of this Activity for 1933.

Retiring President Feted

During the Annual Meeting, President Scaife heard many words of commendation for the splendid services that he has rendered during a trying period. In token of their affection and esteem, the members of the 1932 Council had prepared for Mr. Scaife an embellished certificate expressing their appreciation and admiration. They also presented him with a motion-picture camera and projector.

KELLER DEALS WITH THE HUMAN EQUATION

Policy Involves Mutual Understanding between Executives and Workers

K. T. KELLER

K. T. KELLER'S address, entitled Production, a Human Equation, got a fine reception from those members, mostly production executives, who attended the production luncheon. R. A. Vail, as Chairman, introduced the speaker, who is vice-president and general manager of the Chrysler Corp. Mr. Keller showed by graphical charts that the automotive industry employs about one-third of all workers in Detroit, and indicated how employment varies with seasonal fluctuations in the demand for cars. The automobile industry, he said, does better than most other industries in its efforts to minimize fluctuations of this character.

Proper and considerate control of the human element, the speaker indicated, involves having a policy and placing responsibility on foremen with whom executives are in constant touch. Foremen must be willing to cooperate. At the Chrysler plant the foremen attend many classes dealing with subjects they select themselves. Frequent short contacts with executives aid in cooperation and enable oral instructions to be given which are less likely to be misunderstood than written ones.

Those who joined in the brief discussion included A. F. Knoblock, L. V. Cram, Norman G. Shidle and J. E. Padgett. Mr. Knoblock seemed to voice the prevailing sentiment when he said that if industry as a whole had followed the course outlined by the speaker, which in effect involves having the master craftsman work with the men under him as associates, much less labor trouble would have resulted.

TO FIND FACTS ON HIGHWAY USE

UNDER the chairmanship of T. C. Smith, the Highways Research Subcommittee pledged itself to prosecution of the program formulated last year with special regard for cooperation with Federal and State agencies, such as the Highway Research Board of the National Research Council, the Bureau of Public Roads and the American Association of Highway Officials.

While the Subcommittee, in the absence of funds, will not be in a position to undertake experimental research work on its own account, it is hoped that it may be able, in cooperation with existing agencies, to render advisory service in the planning and direction of scientific investigations of factors and phenomena directly affecting the utilization rather than the construction of the Country's highways.

The Subcommittee agreed that the problem of highway location and design forms no part of its program except insofar as it may directly affect utilization, since the Committee's work thus far indicates that vastly more is known of the materials and construction of highways than concerning the mechanism of their use, the features of which to date, with rare exception, have been matters of opinion rather than fact. It is in the acquisition of this knowledge that the Subcommittee hopes to be of material assistance.

FURTHER RESEARCH ON KNOCK PLANNED

THE C.F.R. Detonation Subcommittee at its luncheon meeting on Wednesday, Jan. 25, maintained its outstanding record for attendance of both members and guests.

The paper prepared by C. B. Veal, H. W. Best, J. M. Campbell and W. M. Holaday covering the Subcommittee's progress since the last report to the Society at its 1931 Annual Meeting, was approved for presentation at the Fuels and Lubricants Session on Thursday.

Following the adoption of the C.F.R. Engine Method by the Cooperative Fuel Research Committee, the special editorial subcommittee was instructed to draft the method in proper form for presentation to the American Society for Testing Materials. The form of this method prepared was adopted by the Detonation Subcommittee, which also approved in substance the Road-Test Method, as drawn up by Chairman A. L. Beall of the Road Test Correlating Subcommittee, subject to possible revision by the editorial subcommittee. The latter group was instructed to seek the advice and cooperation of members of the Detonation Subcommittee and others who are familiar with the details of road-test work in preparing the final form of the road-test method.

The suggestion of the cooperating British Committee that the strobophonometer, an instrument developed by members of its group, be thought of as a more satisfactory unit to be substituted for the bouncing-pin was considered, and the Secretary was instructed to ascertain the possibilities of obtaining a simple type of strobophonometer for use in comparative tests by members of the Detonation Subcommittee.

A special subcommittee was appointed, headed by Neil MacCoull, to investigate the effect of maintaining constant temperature of the intake mixture, as compared with maintaining constant-heat input into the intake mixture, with due consideration given to the British Committee's contention concerning the desirability of heating the intake air to the carbureter to a definite temperature, in view of the considerable variations in atmospheric temperature in different localities.

A FITTING CLIMAX FOR A GREAT MEETING

Eddie Guest Philosophizes, "Ket" Tells Stories and Crawford Talks at Thursday Dinner

HILARITY closely approaching a complete state of hullabaloo prevailed at the Dinner on Thursday evening until Toastmaster E. V. Rippingille, Chairman of the Detroit Section, introduced Edgar A. Guest; then the ensuing quietness and attention, with interpolations of appreciative laughter, gave evidence of Mr. Guest's popularity and his ability to attract and hold his audience. The 700 members and guests assembled in the ballroom of the Book-Cadillac felt the magnetic quality of Mr. Guest's personality as he read selections from his works, interspersing his reading with bits of philosophy and humor.

A. J. Scaife and Dr. H. C. Dickinson, the respective outgoing and incoming Presidents of the Society, were called upon to say a few words, after which General Manager Warner expressed appreciation for the hospitality of the Detroit Section to the visiting members, and Charles F. Kettering evoked a round of applause when he told two stories in his own delightful style.

James M. Crawford, chief engineer of the Chevrolet Motor Co., upon being fittingly introduced by Toastmaster Rippingille as the *piece de resistance* of the program, spoke interestingly on the subject of the engineer's opportunity. Briefly reviewing the history of the automobile industry, from the early days when the engineer guided the destinies of the automobile business, through the period of expansion when the manufacturing end received chief emphasis, into the times when the sales and advertising departments came into control, Mr. Crawford stated that one of the effects of the present economic situation has been the tendency to allow the engineer to return to an important place in the picture. Engineers, he said, have waited a long time for such a chance and now the question that confronts the fraternity is: What are you going to do with this chance? The engineers, he said, may treat their problems as something to be attacked by themselves as a strictly engineering job or to be solved with the cooperation of other departments in their organization. In his opinion, the better course will be to approach problems cooperatively, maintaining close contact with the production force, the advertising and sales forces, the service department, the research men, and, in fact, all the other branches of the business, with the object of getting the most out of men, machines and materials, and participating in the progress of the industry that will come through the cooperative development of new ideas.

E. V. Rippingille

J. M. Crawford

MEETINGS, NOMINATING AND PLACEMENT COMMITTEES MEET

PLANS were outlined, suggestions were received and discussed, and items essential to the walfare and progress of the Society received attention at the respective gatherings of the Meetings, Nominating and Placement Committees, held during the week of the Annual Meeting.

Placement Committee

The Placement Committee reviewed suggestions for extending every possible aid to unemployed members of the Society. Among the specific items under discussion was the possibility of encouraging the wider distribution of employment. Reports were given to show that a number of progressive S.A.E. Sections are making appreciable headway in cooperation with the efforts that are being extended by the Society through its Employment Service. Frequent mention has been made of these operations in the columns of THE JOURNAL.

Nominating Committee

The Nominating Committee met according to schedule, with 14 members present and 11 Sections represented. This was an organization meeting of the Committee, and results of the deliberations will not be available until late in the present year.

Meetings Committee

The principal topic of discussion by the Meetings Committee was the recommendation to the Council that the Committee would prepare with regard to the location of the 1933 Summer Meeting.

Norman G. Shidle, Chairman of the 1933 Meetings Committee, called the meeting to order and conducted the business during the initial stages, after which he turned the meeting over to Alex

(Concluded on p. 34)

KETTERING CALLED IT VERSATILE

Annual Dinner Satisfied Varied Tastes—Serious and Humorous Addresses Followed Musical Numbers

KETTERING, meaning exactly what he said and saying precisely what he meant, alluded to the versatile nature of the program; and, as usual, "Ket" was right. He was referring to the program of the Society's Annual Dinner, at which he presided on the evening of Wednesday, Jan. 11, 1933, at the Hotel Pennsylvania, New York City; and his listeners felt that he very aptly characterized the succession of interesting events brought forth for their entertainment.

As a charming prelude to the matters grave and gay that Mr. Kettering was to introduce in the course of the evening, two well-loved songs were delightfully rendered by Reinald Werrenrath, famous baritone and star of the current Broadway attraction, Music in the Air. The enthusiastic reception accorded Mr. Werrenrath's performance at the Dinner was proportionate to the great pleasure felt by all who heard him and indicative of their appreciation of his graciousness in consenting to sing for them.

Immediately after calling the meeting to order and introducing the distinguished guests at the speakers' table,

BANCROFT GHERARDI

C. F. KETTERING

Toastmaster Kettering asked for a moment of silence, as a tribute to the memory of "one of the very staunch members of the S.A.E. who has gone to the other world—Fred S. Duesenberg."

Election of Officers Announced

President Scaife, being introduced at this time, convened the annual business session of the Society and called upon W. E. John, Chairman of the Tellers of Election, to read the report announcing the election of officers and councilors for the coming year. The names comprised in Mr. John's report are given in the box on this page. The other tellers of election besides Mr. John were Carl F. Scott and Austin M. Wolf.

Following the reading of the report, President Scaife mentioned the fact that considerable has been said about having too much government in business and not enough business in government. Yet, he pointed out, in these days of distress all classes are clamoring for help from the Government; "even the Society, in accord with present-day thought, has elected as its new President a man from the Bureau of Standards to run the Society this year".

At the conclusion of President Scaife's remarks, a motion was made and unanimously carried that the business session be adjourned, to reconvene at Detroit later in the month in connection with the Annual Meeting.

President-Elect Dickinson, being called upon to say a few words, emphasized the important place held by the engineer in world affairs. Other professions, he pointed out, are devoted to the task of conserving the fruits of past achievements, whereas engineering is essentially the creative profession. Accordingly, he looks to the engineers, the creative element in society, to contribute their talents effectively toward remedying present difficulties.

Gherardi Cites Baseless Fears

Bancroft Gherardi, vice-president of the American Telephone & Telegraph Co., after being introduced by the toastmaster, called attention to the similarity between the automotive and the telephone industries, in that each gives an extension of personality, the former by carrying people, the latter by carrying the spoken word from one place to another. Proceeding farther with the idea of fundamental similarities, he pointed out that it can be said of each that it ministers to a basic need of civilization; is mechanical and electrical in its nature; is a product of fundamental ideas developed in the 19th century, growing to its present size in the 20th century; that it was and will be dependent on science and engineering for development; that it has largely done its own development work within the industry, and that it feels the present depression.

Regarding the depression, Mr. Gherardi delivered a refreshing message in which he showed the folly of fear. As proof of his thesis, he quoted from statements uttered during previous depressions which so closely parallel many pessimistic comments on the present situation as to be almost humorous. Pointing out the likeness that seems to exist between the present depression and earlier ones, he indicated that the "scare psychology" had in times past proved foolish and he drew the inference that it is equally futile today.

To bring a touch of gaiety to the meeting after Mr. Gherardi's serious and thought-provoking address, Rube Goldberg, cartoonist and writer, elicited one laugh after another when he told of his invention of the balloon tire and con-

ROY FAULKNER

tinued by describing the design and operation of his fearfully and wonderfully made windshield wiper.

Faulkner's Inspiring Talk

Roy Faulkner, president of the Pierce-Arrow Sales Corp., delivered an intensely practical exposition of the relationship between engineering and selling. He gave the engineers reason to believe that they have done their full share to bring about the phenomenal growth of the industry and have left the sales force with rather heavy obligations to equal or exceed the performance of the technical men. He decried the situation that all too often has prevailed in industry, where a brilliant concept, presented by a technical man occupying a subordinate place in the organization, passes through the hands of official superiors until it finally emerges from the fire of comment and change bereft of its original values, largely in order that the final man in the chain might place his name on the design.

Looking toward the future, prophesying that previous achievements will be surpassed by developments that are yet to be made, Mr. Faulkner expressed the belief that the greatest progress will come when genius that has been kept down, hidden, double-crossed and throttled in times of prosperity, will be welcomed into the conferences of the mighty under the stress of dire conditions; that is, when the originality now lying dormant in many organizations will be recognized, released and encouraged.

A distinguished audience of nearly 700 executives and engineers gave unmistakable evidence of their enjoyment of the varied entertainment that had been provided for them. Seated at the speakers' table, in addition to Toastmaster Kettering, Messrs. Faulkner, Gherardi, Goldberg and Werrenrath,

Officers for 1933

President: H. C. DICKINSON

Vice-Presidents

C. M. YOUNG, representing aircraft engineering

A. V. D. WILLGOOS, representing aircraft-engine engineering

HARTE COOKE, representing Diesel-engine engineering

M. C. HORINE, representing motor-truck and motorcoach engineering

J. M. CRAWFORD, representing passenger-car engineering

R. F. ANDERSON, representing passenger-car-body engineering

FRED CEDERLEAF, representing production engineering

J. F. WINCHESTER, representing transportation and maintenance engineering

Members of the Council

To Serve for One Year

S. O. WHITE R. E. WILSON

H. T. WOOLSON

To Serve for Two Years

W. T. FISHLEIGH G. W. LEWIS

W. G. WALL

Past Presidents

A. J. SCAIFE VINCENT BENDIX

Treasurer: DAVID BEECROFT

RUBE GOLDBERG

REINALD WERRENRATH

President Scaife and President-Elect Dickinson, were the following:

J. C. Hunsaker, President of the Institute of the Aeronautical Sciences; F. H. Russell, President of the Manufacturers Aircraft Association; Floris Nagelvoort, President of the National Automobile Dealers Association; Howard Coonley, President of the American Standards Association; Cloyd M. Chapman, President of the American Society for Testing Materials; D. R. Grossman, President of the Canadian Automobile Chamber of Commerce; George L. Brunner, President of the Motor & Equipment Manufacturers Association; A. A. Rowse, Director of Morris Motors, Ltd., England; Henry R. Sutphen, President of the National Association of Engine & Boat Manufacturers; A. Gelpke, of the Autocar Co., Chairman of the Annual Dinner Committee; J. E. Hale, President of the Tire & Rim Association; Arthur M. Hill, President of the National Association of Motorbus Operators; and the following Past-Presidents of the Society: B. B. Bachman, David Beecroft, Vincent Bendix, Howard E. Coffin, H. L. Horning, J. H. Hunt, W. G. Wall and Edward P. Warner.

C. A. Vane, who attended the Dinner despite a recent severe illness, was affectionately introduced by the toastmaster.

Expressing his own appreciation and voicing that of the audience for the splendid program, Toastmaster Kettering was enthusiastic in his praise of Fred E. Moskovics, whose cooperation made possible the securing of performers of such rare merit as Messrs. Gherardi, Goldberg and Werrenrath. In like

manner he spoke warmly of the debt of thanks due to Norman G. Shidle, through whose efforts Mr. Faulkner was prevailed upon to speak at the Dinner.

Chairman A. Gelpke, A. L. Beall and Walter C. Keys, who composed the Annual Dinner Committee, are to be congratulated upon their planning and management of what proved to be a thoroughly interesting and successful event.

MEMBERSHIP PLANS WELL FORMULATED

(*Concluded from p. 27*)

Teetor's Committee were the desirability of holding meetings early in the month so that suitable reports might be published in the S.A.E. JOURNAL; the necessity of a regular review of mailing lists; and questions of Section finances.

As an example of something new and progressive in Section operation, the Sections Committee was particularly pleased to receive a sample of the new *Booster* of the Metropolitan Section, which was presented by A. L. Beall of New York City. The November issue of this *Booster*, typical of others, contained a report of forthcoming meetings and the *complete* text of the technical paper and discussion that were presented at the immediately preceding meeting of the Section.

Those who attended the Sections Committee Meeting were:

A. L. Beall
H. C. Dickinson
Murray Fahnestock
J. C. Geniesse
P. J. Kent
C. R. Noll
Hoy Stevens
Alex Taub
R. R. Teetor
John A. C. Warner
R. E. Wilkin

Those who attended the Membership Committee meeting were:

A. L. Beall
F. K. Glynn
W. E. Kemp
W. C. Keys
E. F. Lowe
R. J. Noll
V. P. Rumely
J. W. Shields
Alex Taub
J. W. White
John A. C. Warner
C. B. Whittelsey, Jr.

MEETINGS COMMITTEE MEETS

(*Concluded from p. 31*)

Taub, Chairman of the 1933 Committee. Chairman Taub outlined plans for meetings activities that promise to provide plenty of controversial matter and to release much valuable information from our engineering laboratories and manufacturing plants.

REGULATION DISCUSSED AT HIGHWAY CONGRESS

Its Adverse Economical Effect on Manufacture and Operation of Vehicles Shown by S.A.E. Papers

THE PENALTY that motor-truck fleet operators, especially the contract carriers, and the manufacturers are being forced to pay, because of the lack of reasonable uniformity in the regulatory restrictions on vehicle dimensions and weights and the burdensome and increasing taxes being levied against them, was the topic of papers presented by M. C. Horine and Pierre Schon at the Highway Transportation Session at the Detroit City Airport on Jan. 18.

The session was presided over most ably by W. G. Fitzpatrick, vice-president and general counsel of Eastern Michigan Motor Buses, and was attended by fleet operators, motor-truck association officials and representatives of regulatory bodies from several parts of the Country, a number of whom supplemented the papers with remarks and suggestions that indicated growing concern over the trends of vehicle regulation and taxation.

Legislators Ignore Economic Facts

The Motor-Vehicle Manufacturers' Problems Caused by Lack of Uniform Regulation and Legislation was the topic of Mr. Horine's paper, which stated that, by their lack of uniformity and disregard of scientific and economic facts, legislative restrictions on motor-transport vehicles now in force in the various States militate against efficient transportation and thus retard economic recovery. In this indirect way and in several direct ways, the same situation presents problems to truck builders. Variations in State requirements necessitate undue diversity of designs, present difficult engineering problems, discourage enterprise, threaten the American system of production and penalize good engineering and sound manufacture.

Although the pertinent facts that should form the basis for equitable legislation of this kind have been determined by the most painstaking scientific research and experiment, under the most responsible auspices and with the endorsement of the highest authorities and have been given wide circulation, the States generally seem to have imposed restrictions on motor-trucks less for the benefit of the public than to favor selfish interests. Dire results are likely to ensue unless the present oppressive trend of motor-truck legislation is arrested and legislation based upon fact and fairness, uniform as between States, is substituted for the crazy-quilt of present State truck legislation.

Aside from the effects of legislative regulations, manufacturers find themselves greatly affected by taxation policies, the author stated. Excessive gasoline taxes have exaggerated the importance of fuel costs, and, although vehicles can be built for economy of fuel as the chief object, the maximum economy must be achieved by sacrifice of both performance and mechanical sturdiness. High gasoline taxes thus impair sound engineering in truck design because they penalize weight, power and durability.

Regulations Diminish Returns on Huge Highway Investment

In normal times the manufacture of motor-trucks is a $500,000,000 industry, continued Mr. Horine, with an invested capital of about $400,000,000, and is an integral part of our largest industry. The United States is each year investing $1,700,000,000 in highways and $500,000,000 in streets for vehicular traffic, to which might be added other huge sums represented by complementary equipment owned by operators. The only way in which the public can receive a return on this colossal investment in highways is through the safe and economic utilization of motor-vehicles. Government has no higher function than the safeguarding of the persons and the well-being of its citizens.

The chief arraignment of motor-truck legislation is not its effect upon the narrow interests of particular manufacturers, but rather that broader influence which it has upon national prosperity as so greatly affected by the cost and convenience of motor transport. What is needed is legislation that is good for every man, which brings the necessities and luxuries most quickly, easily and cheaply to the door of the common man.

With that, motor-truck manufacturers will be content.

The paper included 12 appendices tabulating detailed comparisons of the dimensions and weights at present specified in all the States, and showing the wide variations that are handicapping the most economical manufacture and operation of motor-trucks.

Schon Argues for Uniformity of State Laws

Mr. Schon's paper pointed out the great need for uniformity of State motor-vehicle codes and the destructive results of sudden changes in legal regulations affecting sizes and weights of motor-vehicles. Through recent enactment of new laws, equipment worth millions of dollars has been outlawed in several States and operators are facing losses of additional millions through premature obsolescence of commercial vehicles that may be outlawed by new regulations now pending in 43 States in which the legislatures are scheduled to meet in regular session this winter. A uniform code, when and if adopted by all States, would greatly simplify manufacturers' and operators' problems and would result in standardization of design and enforcement practice.

Many of the legislative regulations have a sound basis for existence. Measures restricting gross vehicle weight to a reasonable amount, restricting the weight per axle and the length and width of vehicles to reasonable limits, measures aimed at greater safety on the highways and a fair basis of taxation are, conceded the speaker, obviously necessary and in the interest of the public welfare. When regulation, however, goes beyond the point of protecting the interest of the public and is used by selfish interests merely to stifle a form of legitimate competition, it is time that the public in general and truck manufacturers and owners in particular cooperate in a strongly organized protest against such unfair regulatory measures.

Should Combat Antitruck Propaganda

In working toward national uniformity of regulations, the Bureau of Public Roads, the American Association of State Highway Officials and the National Automobile Chamber of Commerce are in accord insofar as physical dimensions and vehicle weights are concerned, continued Mr. Schon, but nationwide antitruck propaganda will bring before our State legislatures proposals supported by selfish interests contrary to those incorporated in the recommended code. Opposition will also come from a limited number of operators in certain States where present regulations are very liberal and where the recommendations in this new code would create a hardship by removing a limited number of large-vehicle combinations from the highways.

When it is fully understood, however, that the standard bills supported by the lobbyists for certain special interests call for a maximum gross weight of 20,000 lb. for a four-wheel vehicle and 28,000 lb. for a six-wheeler or a combination of vehicles, and when we realize that three-fourths of the States now have laws limiting vehicle weights to less than the weights proposed in the recommended code, there really is no reason why the recommendations originated by our highway engineers through their organization, the American Association of State Highway Officials, should not receive the full support of every organization interested in the development of highway transport.

TRUCK SIZES AND TYPES AFFECTED BY STATE RESTRICTIONS

STATE	5 Ton			7½-Ton			10-Ton			15-Ton	
	Four-Wheel	Six-Wheel	T-S-T	Four-Wheel	Six-Wheel	T-S-T	Four-Wheel	Six-Wheel	T-S-T	Six-Wheel	T-S-T
Alabama	....	G	G	G	G	G	G	G	G	GW	G
Arizona	....	....	....	GA	A	....	GA	G	G	GAW	ALF
Arkansas	....	....	....	A	....	....	A	....	A	AFW	GA
California	....	....	....	GA	....	....	GA	G	G	GAW	G
Colorado	....	....	....	....	....	....	GA	....	....	GAW	A
Connecticut	....	....	....	....	....	....	G	....	....	G	G
Delaware	....	....	....	A	....	....	GA	....	A	GAW	GA
Florida	GW	G	G	GW	GW	GW	GW	GW	GW	GW	GW
Georgia	....	....	....	A	....	....	A	....	G	GAW	GA
Idaho	....	....	....	GA	....	....	GA	....	A	GAW	GA
Illinois	....	....	....	GA	....	....	GA	....	A	GAW	GA
Indiana	....	....	....	AW	....	....	A	F	AF	AWF	AF
Iowa	....	....	....	A	....	....	AF	F	AF	AWF	AF
Kansas	....	....	....	A	....	....	GA	G	....	GAW	GA
Kentucky	G	G	G	G	G	G	G	G	GL	GWL	GL
Louisiana	P	P	P	P	P	P	P	P	PG	PW	PG
Maine	....	....	....	GA	G	G	GA	GA	G	GAW	GA
Maryland	....	....	....	....	....	....	GW	W	W	GW	GW
Massachusetts	....	....	....	....	....	....	G	....	....	GW	G
Michigan	....	....	....	A	A	....	A	A	....	AW	A
Minnesota	....	....	....	A	A	....	A	A	....	AW	A
Mississipi	A	....	....	GA	GA	A	GA	GA	GA	GAW	GAL
Montana	....	....	....	GA	....	....	GA	GA	G	GAW	GA
Nebraska	....	....	....	A	....	....	PA	PG	PGA	PAW	PGA
Nevada	....	....	....	....	....	....	G	....	....	GW	G
New Hampshire	....	G	....	GA	GA	....	GA	G	GA	GAW	GA
New Jersey	....	....	....	....	....	....	G	G	....	GW	....
New Mexico	....	....	....	A	....	....	A	F	F	AWF	AF
New York	....	....	....	....	....	....	A	....	....	GAW	....
North Carolina	....	G	....	GW	G	....	GW	GW	W	GW	GW
North Dakota	....	....	....	A	....	....	A	....	A	AW	A
Ohio	....	....	....	GA	G	....	GA	G	....	GAW	A
Oklahoma	....	G	G	GAW	G	G	GAW	GW	GAW	GAW	GAW
Oregon	....	....	....	A	....	....	A	....	....	AW	GA
Pennsylvania	....	....	....	A	....	....	GA	....	G	GAW	GA
Rhode Island	....	....	....	....	....	....	GA	....	....	GA	G
South Carolina	....	....	....	GAW	GA	G	GAW	GAW	GAW	GAW	GAW
South Dakota	....	G	....	GA	G	....	GA	G	G	GAW	GA
Tennessee	....	G	....	GA	GA	....	GA	GA	G	GAW	GA
Texas	P	P	P	P	P	P	P	P	P	PW	P
Utah	....	....	....	A	....	....	GA	G	G	GAW	GA
Vermont	G	G	G	G	G	G	G	G	G	GW	G
Virginia	....	....	....	GA	....	....	GA	G	GA	GAW	GA
Washington	....	....	....	G	....	....	GA	GA	....	GAW	GA
West Virginia	....	....	....	A	....	....	A	....	A	AWF	AF
Wisconsin	....	....	....	G	....	....	GA	....	....	GAW	GA
Wyoming	....	....	....	A	....	....	A	F	F	AWF	AF
District of Columbia	....	....	....	....	....	....	G	....	G	GAW	GL
All Right	43	38	42	9	30	39	0	17	14	0	2
No Good	6	11	7	40	19	10	49	32	35	49	47

Symbols: A=Axle Load; F=Formula; G=Gross Weight; L=Length; P=Payload; T-S-T=Tractor and Semi-Trailer; W=Weight.

Discussion Raises Important Considerations

Much of the discussion of the papers related largely to the experience of individual operators, but one of the important points raised was the limiting of the mobility of military-transport equipment by bridge clearances that might be based on the height restrictions in State regulations. Another important consideration not fully appreciated is that a very large percentage of freight haulage to and from railheads is by motor-truck and the enforcement of many of the severe restrictions on trucks will make it impossible to maintain this service efficiently, if at all.

What is needed probably more than anything else in the campaign to secure proper uniform State regulation of motor-trucks, asserted one discusser, is coordination of vital statistical data, more unified organization of motor-transport operating interests and a more effective educational campaign that will reach the people as a whole and stir their interest

(Concluded on p. 48)

CHRONICLE & COMMENT

Important Announcement Made at Chicago

Outstanding among the events of Automobile Show Week in Chicago, was the dinner of our Chicago Section on the evening of Jan. 31. Arranged by Chairman L. V. Newton and his committees, the program was conducted by F. K. Glynn. As speakers, W. B. Stout and Norman G. Shidle left nothing to be desired.

Toastmaster Glynn was the recipient of numerous telegrams which assisted him materially in "ticking off" the various events of the evening in unique manner. He used one of these, a message from John A. C. Warner, Secretary and General Manager of the Society, as a combination introduction and announcement in the case of one of the speakers.

Mr. Warner's telegram announced his appointment of Norman G. Shidle, formerly directing editor of the Chilton Co., as Executive Editor of the S.A.E. JOURNAL.

Mr. Shidle holds a high place as an authority on automotive subjects, gained through his journalistic and merchandising activities during 13 years of association with the automotive industry. Joining the staff of *Automotive Industries* in 1919, he later became editor of that publication and subsequently directing editor of all Chilton magazines. He has just finished a term as a member of the Council of the Society and has for several years been Chairman of the general Meetings Committee of the organization. He is a member of the Contest Board of the American Automobile Association and has been vice-president of the National Conference of Business Paper Editors.

In the 1931 contest conducted by the Associated Business Papers, he won first prize for the best series of articles in any business publication, the prize-winning series having dealt with the battle for the replacement parts market which was and still is being waged between vehicle manufacturers and independent parts makers.

Mr. Shidle brings to the S.A.E. JOURNAL a thorough knowledge of editing, ability to present technical subject-matter vigorously and forcefully, and a broad general background on every phase of the automotive industry.

PRODUCTION ENGINEERING

Industry Urged To Adjust to Buying Power

By N. N. MANNING

THE years 1930 and 1931 were striking examples of over-estimates on the part of the management of nearly every company engaged in the manufacture of automobiles, with the result that nearly all companies found themselves committed for material and to a program far in excess of the remotest possibilities of distribution. The outcome was that word went forth to the sales organizations to clean up all inventories preparatory to the introduction of new models, and sacrifices were made in many cases below the actual cost of labor and material, with the result that no stabilization of prices has been possible and we have developed a buying public of bargain hunters. We should not blame the public, for we would all do the same thing were we fortunate enough to have money with which to take advantage of such bargains. We should, rather, look within the industry and make sure that whatever course we adopt will be a safe one and one which will enable us to produce economically such minimum number of units as can be disposed of economically.

The year 1932 saw many of these ills corrected and most companies were prepared to start in 1933 with a clean slate, but I am afraid with plans to provide for a much greater volume of cars than the public can absorb under present buying capacity.

Let us be satisfied in this industry to estimate carefully the volume that can be economically produced and distributed during 1933.

Should Help Re-establish Buying Power

It is needless to state that making good automobiles and quantities of them does not solve this problem of distribution. We may not realize just what influence we at the tail end, as it were, may bring to bear in reestablishing of purchasing power. The facts remain, however, that the automobile industry was among the worst offenders in respect of over-extension of credit and over-expansion of production. Is it not reasonable to believe, therefore, that we should be the first to set an example to other industries in retracting to a normal and economical basis of operation? In this way we shall not only reestablish confidence in ourselves, but by so doing will go a long way toward instilling that confidence in business with which to lead to a normal recovery.

This country more than any other has operated on a mass-production basis in the manufacture of automobiles and units of a similar nature. While supplying human needs, this has worked out very satisfactorily, but with the gain in momentum, we must necessarily reach a point where the elastic limit is exceeded and the structure falls. I am not prepared to say that mass production is not justified, but rather, on the contrary, that the methods of production must be determined by the conditions surrounding the demand; also, that mass production with costly investments in tools, plants and equipment has not been justified in the last two years, and that just as soon as we realize that a balance must be maintained between production and consumption, just so soon shall we cease to write off huge losses in unabsorbed tools and idle equipment and restore to labor

Recommends Investing Less in Tools and More in Unit Cost

that portion of work to which it is justly entitled, paying to stockholders a return commensurate with their investments.

We should, by making a conservative estimate of the demand, be able to determine to what extent we are justified in making initial investments in tools and equipment for production. We shall often find that the safest basis on which to proceed is to invest less for tools and spend more on the unit cost, which will enable us to meet whatever the demand may be and face the uncertainty of having to write off unabsorbed charges at the end of the year.

Let us put aside forever the "volume complex" and study carefully our production plans from an economical standpoint, based on a conservative estimate of consumption.

As a basis for further safe procedure and while operating under uncertain conditions, let us consider this minimum volume as normal and provide for additional demands by overtime or increase in regular working hours. Had the automobile industry observed this fundamental principle, how much better off we should be today! We would not be overburdened with idle plants, idle machinery and burdensome taxes and would be forced and assisted in stabilizing employment.

The question then arises, What are we to do while all this is being worked out? Surely we must see and realize that this is a temporary condition, its period of duration limited and that we must and will continue to be progressive. We may be criticized for building too many cars; but the automobile answers a human need and, so long as we satisfy that need either at reduced costs or by building a better product, the future will welcome us.

In the development of our present industrial system, the engineer has, through lack of choice, been forced to concentrate on engineering and production problems in their application to machines. The operations of a future successful social order will demand the same degree of concentration in effecting the stabilization and maintenance of a uniform employment system. When the above has been fulfilled and labor again reinstated in our shops, just so soon shall we absorb our overhead and industry will again build up adequate cash reserves to maintain business in a healthy and normal condition.

[This is an extract from a paper presented at a meeting of the Detroit Section. The author is general manager of the Le Baron Detroit Co., Detroit, and a Member of the Society.]

NOISE CAUSED BY GEARS

Gear teeth form a loose connection that is very favorable to the transformation of vibration into sound, according to T. J. Bannan, of the Western Gear Works, Seattle, who presented a paper on Gears at a recent meeting of the Northwest Section. This sound, emphasized by the gear teeth, often produces a result that is highly objectionable. Analyzing the cause of noise in any particular set-up is not simple, but certain different kinds of defects in gears cause typical noises such as (*a*) an intermittent clicking or steady growl, usually caused by poor spacing or irrebularly formed tooth profiles; (*b*) a pulsating growl or sound of varying intensity at regular intervals which usually is a runout sound caused by eccentricity of the gears and (*c*) a high-pitched squeal, most often caused by rough tooth surfaces. These three noises can easily be corrected by improving the workmanship or installation of the gears. Other sounds or combinations of sounds built up by vibration cause more trouble and are considerably more of a problem. The same inaccuracies that cause increment loads cause noise and, when one considers the number of impacts of teeth coming into mesh in a fairly high-speed gearset, one is likely to be surprised that there is not more noise. If one considers the number of teeth that are meshing or contacting in a constant-mesh automotive ransmission, one will understand the automobile manufacturers' noise problem.

The ear can distinguish sounds arising from 32 to 38,000 vibrations per second. Vibrations of frequencies within this range are met regularly in gear practice. Most gearboxes act as an amplifier for any kind of noise, and it is a known fact that the design of the gearbox has much to do with the degree or amplitude of noise emanating therefrom. The gearbox can be designed to damp the noise, and the lubricants also affect its volume.

Various automotive and gear manufacturers, realizing that some sounds are always present, have made an effort wherever possible to damp vibrations so that sound will be produced in the lower pitches or tones, these usually being considered less unpleasant. Considerable effort is being made also to use sets of gears which will produce sounds that are harmonious rather than discordant. Some of the European automobile manufacturers are now using transmissions with all of the gears on the countershaft made with the same number of teeth. They change the pitch of the teeth to give the desired reduction ratio, but secure a single tone due to the fact that the number of contacts per second is with each set of gears.

TRANSPORTATION ENGINEERING

Correct Use of Employe-Owned Cars

By J. M. ORR

EMPLOYE-OWNED passenger cars, correctly applied and used, have demonstrated their ability to provide certain business passenger-transportation requirements satisfactorily, according to J. M. Orr, whose Transportation Meeting paper was entitled The Use of Employe-Owned Cars in Business and was subsequently presented at the November, 1932, meeting of the Pittsburgh Section. The relationship between employer and employe in this class of service is interesting because of its unusual character, which differs somewhat from that which normally exists between them, he continued. The paper follows:

The employer is impersonally interested in securing adequate, satisfactory transportation at reasonable cost, and the employe is interested in furnishing the transportation required for his job upon the most favorable basis of remuneration. The few dollars that the employe receives for the use of his car are of much greater significance to him in his personal budget than those same dollars are as a part of his employer's transportation budget. When using his car on company business, the employe is in the unusual position of being on the other side of the table from his employer—one being the buyer, the other the seller—due to the employe's personal interest in effecting the most favorable arrangement. A basic difference in underlying economics is obviously apparent in employe-owned versus company-owned service, which necessitates recognition and accurate evaluation in any successful employe-owned plan.

Cost per mile operated is inversely proportional to use factor, or miles per vehicle month. Experience shows that, except in unusual cases, a car used solely by one employe does not develop as high a use factor as a car used by several employes on company business. It follows that a company's passenger-car needs are best supplied by company-owned cars centrally pooled and dispatched to users as the need arises. Company-owned vehicles should be stored in company garages at night, to reduce personal and dead mileage to the minimum and permit necessary maintenance during off-peak vehicle hours. This results in attaining the highest possible business-use factor, the greatest amount of transportation per dollar of investment and the lowest total cost of operation.

The field of employe-owned car application is then limited to cars for individual use where pooled company equipment is not available, or for jobs upon which, for some particular reason, emplove-owned is more desirable than company-owned service. For instance, employes whose working hours are irregular, or those whose duties require occasional, unanticipated, immediate use of a car at night, may best use an employe-owned car on account of its availability and probable serious loss of time in securing other vehicular service, such as company-owned, taxicab or drive-yourself. Salesmen, or supervisors responsible for 24-hr. operation, are types that come within this group.

Certain basic principles must be adhered to in any arrangement made for the use of an employe's car on company business, or misunderstanding and dissatisfaction will embarrass employer and employe.

Relationship Between Employer and Employe Outlined for This Class of Service

Basic Principles To Be Observed

(1) The use of an employe-owned car on company business should be a prerogative of the job, not of the individual. This places the matter on an impersonal basis and relieves the employer from any obligation to continue the arrangement or rate if duties or transportation needs change, or in the event that a car has been purchased for the primary purpose of using it in company work.

(2) Rates paid for the use of employe-owned cars should be no higher than the cost of similar service supplied by company-owned vehicles of a make and type considered suitable and adequate by the employer.

(3) Rates should be revised as often as is necessary to conform to changed transportation requirements and costs.

(4) Employe-owners should not expect to realize a profit from the use of their cars on company business. They should be satisfied with and willing to bear a proper portion of total cost for personal use and availability.

(5) The type of car used should be in keeping with the job.

(6) Unlimited company-mileage authorizations should be given only to men in major supervisory positions, or to those making comparatively high salaries. Limited authorizations, that is, those in which a maximum mileage or reimbursement per month is established, can be granted to employes not meeting these requirements.

(7) No plan should be adopted or changed without consideration of the resultant effect upon the employe-owner.

Every business organization has its own peculiarities that will influence the degree of success or failure of employe-owned service.

The executives charged with the formation or administration of employe-owned plans must be fair-minded men who have the ability to see the employe-owner's viewpoint. They should be mindful of the peculiar economics involved and the bad effect of poor or unfair decisions upon employe morale and welfare. They should not come to look upon reimbursements for employe-owned cars, in whole or in part, as a portion of wages or salaries paid. Their treatment of the problem should always be on a group basis, impersonal to the extent that no particular employe-owner receives preferential treatment or consideration over that accorded to other employes.

The employe-owner should recognize the peculiarities of this class of service, clearly understanding the terms and conditions upon which he is selling miles to his employer. He should appreciate that the need for the service may change at any time and that the arrangement is unsound if it is inflexible and cannot be treated impersonally the same as a service purchased from outside sources. He must not look upon the moneys received for the use of his car as a part of wages or salary. His car must be kept in good mechanical condition and appearance. He must be able to replace it with a new one at the proper time. As a suggestion, his ability to properly discharge his part of the obligation will be assured by the establishment of a separate car bank account into which reimbursements are paid, and from which car expenses are paid, with no diversion of funds to other uses.

I know no instances of where employe-owned cars are used for company business only. An appreciable portion of the average owner's total mileage is personal. The use of one car for both purposes is a decided economic and financial advantage to both parties at interest. No reluctance should be shown by the employe-owner to stand a proper pro-rata share of total cost for personal use, which is certainly less than the cost to him of a similar car for personal use only, or which permits his ownership and use of a better car than he could afford for personal use only with no company participation in its fixed charges. In an organization where employer and employe-owners can subscribe to these or similar specifications, use of employe-owned service can be undertaken with good assurance of a fair trial.

Eligible Types of Business

What types of business or fleets lend themselves most readily to the use of employe-owned cars, and what degree of balance or coordination should exist between them and company-owned cars? The type of operation best suited to employe-owned service is one containing very few or no trucks, with low vehicle-density at any point but with scattered sales or similar representation for which transportation is to be provided. Its advantages over company-owned service decrease and almost disappear as vehicle density increases.

Use has been made of both types of service in some operations. Employe-owned service

[The author is a member of the Society and general manager of the Equitable Auto Co., Pittsburgh, which is affiliated with the Duquesne Light Co., Pittsburgh. He represented the National Electric Light Association at the S.A.E. Transportation Meeting.]

has been used as a medium to permit unrestricted personal use and limit the company's transportation expense to that necessary for company business only; also as a method of company-owned-fleet simplification and standardization.

Use of Cars for Sales Work

In sales work, where mileage is difficult to control, car-equipped men can make more contacts and at the same time the company can limit its total expense by establishing a maximum reimbursement per period, which is not possible with company-owned vehicles. A survey made recently by the Boston Sales Manager's Club covers 2570 employe-owned cars used in six New England States. A year ago 535 were used by 16 Pennsylvania electric-utility companies. One operator has 800. These figures indicate that the use of employe-owned cars is by no means inconsiderable.

My impression is that the average fleet manager and executive look upon employe-owned service as being of minor significance compared with company-owned equipment, perhaps because thorough study is not given to the personally owned car question. I question whether, in many cases, periodic statements showing moneys paid for the use of all employe-owned cars are prepared and made available for a study of their number, cost and application.

Separate Accounts for Car Payments

Car payments should not be paid in connection with regular expense accounts. Special employe-owned expense accounts, that clear through and are approved by the transportation department before payment can be made, should be used. A periodic summary can then be prepared, which, when studied, will yield interesting and valuable information.

Perhaps the lack of attention referred to above is because a line of reasoning is encountered from individual employe-owners that is foreign to that normally taken by those same men on company matters not involving their own prerogatives or pocketbooks. This is not unnatural, and it does not stamp the employe-owner as being selfish or biased. He is interested in selling miles at the best price, and we cannot blame him for that. The best way to get the employe-owner's viewpoint is to drive an employe-owned car one's self.

Employe-owned service cannot be inaugurated in any company without due regard of its effect on company-owned facilities and costs. This is particularly true where provision has been made for self-maintenance of a company-owned fleet, part of which would be eliminated with the adoption of employe-owned service to any extent. Some will say that these facilities can be used on employe-owned cars. This, however, introduces another unusual relationship between employer and employe that has questionable chances of continued satisfaction and success.

Rates Should Be Equitable

Employe-owned rates should not exceed the cost of suitable company-owned vehicles on the same jobs, and there is firm justification for rates to be less if actual cost is pro-rated between business and personal use. Each owner computes costs in his own way; accordingly, little consistency of opinion exists among owners as to whether the rate under a given arrangement is fair. Some claim that they break even, some that they lose money and a few will admit that they make a profit.

Whatever the rate, it should be of simple structure and easily understood. My own preference is for a block-mileage rate that decreases the net return per mile as mileage increases on all applications, with maximum reimbursements established on jobs where controlling or questioning mileage is difficult or upon which the maximum value of a car to the company is predeterminable. The type of rate in mind is X cents per mile for basic requirements of say 500 miles per month, and $X-1$, 2 or 3 cents per mile over the basic first block. This recognizes that cost per mile is inversely proportional to the use factor, discourages the development of higher mileages that are necessary and automatically takes care of variation in work requirements, seasonal use, vacations and illness.

Where more than one class of employe-owned car is desirable, distinction is best made upon the list price of a standard model suitable for company business. For instance, cars listed below $700 would be classed as small and those above $700 and over as large. Where more than one class of employe-owned car is used, the permissible grade should be made a part of the job specifications.

Flat rates per period of use are not desirable, as they do not give a consistently fair and comparable return in money to employe-owners, or car service to employers. It is difficult to establish a flat figure that will remain fair to both parties for any reasonable length of time. Rates based upon a part of total actual expense are undesirable, because of the great variance in the amount of attention paid by different individuals to their cars, their methods of keeping costs, the detailed work involved in submitting reimbursement statements and the inability of the employer to verify their basis or accuracy or to budget and control this phase of transportation costs. Arrangements are unsatisfactory in which employes receive operating supplies, such as gasoline, oil, tires and washing, in lieu of money for the use of their cars.

An allowance may be made for parking charges occasioned by the use of the car on company business, applying only in larger cities where parking on the streets or in company garages is not possible. This should not cover any part of the expense for storage of a car at the employe-owner's residence, which is properly chargeable to personal availability and use. Incidentaly, mileage between an employe-owner's home and his working headquarters can be classed as personal in most cases.

A report for the period of reimbursement, giving daily speedometer readings, with a division of company and personal mileage, is desirable, regardless of the rate basis. This can be a combined mileage report and invoice of convenient size to be carried in the car for daily posting. A detailed monthly report of the cost of employe-owned service should be prepared and made a part of the company's motor-vehicle or transportation-cost report. Sufficient statistics on use factor, cost per mile and the like can be developed to indicate trends and permit cost comparison with company cars.

Method of Authorization

Authorizations for employe-owned service should be made only after careful analysis and consideration of necessity. Precedents must not be set up that will become burdensome or that can be construed as class distinction by the personnel. The use of company-owned equipment is preferable if not more costly; and the transportation department should have the option of supplying the required transportation with company equipment if this is practical and economical.

A written agreement between employer and employe is desirable. The form of agreement, drawn by the legal department, should clearly define the responsibilities assumed by both parties. It should be executed by the employe and approved by his superiors and by the insurance and transportation departments. The insurance department sees that the coverage is of the correct types, adequate in amounts and placed with a carrier of good standing. The transportation department examines age, mechanical condition, appearance, suitability and the desirability of using company-owned equipment on the job. Authorizations should be reviewed periodically to assure continued necessity and that their cost to the employer is fair, equitable and in keeping with the trend of operating costs. Passenger-car development is rapid. New and refined engineering principles are presented by the manufacturers in rapid succession, and a plan that fits today's conditions cannot be expected to endure very long without change.

Insurance Considerations

Proper public-liability and property-damage insurance must be carried to protect the company. The cost of all, or a part, of this coverage can be included in the rate per mile paid, or it can be allowed in addition thereto; but preferably the former. Insurance cost is fixed and adds materially to the cost per mile if added separately to low-mileage applications.

Limits should be the same as are carried by the company on its own vehicles; or, if this, for any reason, is not believed desirable, excess or contingent blanket coverage should be carried by the company.

The employer, or company, should be named as co-assured in each policy, which should, of course, cover both personal and business use. This will minimize the ability of carriers to deny liability on the strength of some fine-print policy-clause or provision and require them to defend claims or suits brought against either the employe or the employer.

The probability of fire, theft and collision loss is almost negligible, particularly if cars are properly cared for and driven. Maximum loss is limited to the depreciated value of the vehicle. I know of no reason for these losses to concern or embarrass the company, if it is understood that the hazards are assumed by the employe-owner in his acceptance of the arrangement or rate, in which some allowance may or may not be made for them.

Certificates from an authorized representative of the public-liability and property-damage carrier can be required to show that an employe-owner has complied with company requirements. Expirations should be followed closely to assure no lapse of coverage; otherwise the authority to use a particular car should automatically cease.

The Pivotal Points

In conclusion, may I express the personal belief that the pivotal points upon which employe-owned service revolves are correct application and use. Management and the employe must agree on the economics involved at the outset. Each must clearly see and respect the advantages to both participants. Authorizations should be made with discretion.

As transportation engineers and managers, we are interested primarily in one thing; that is, to provide all of the transportation required in our business in the most satisfactory manner and for the fewest number of total dollars of cost. Cost per mile, miles per vehicle-month and the like are secondary to that end. I have neither love nor hatred for employe-owned service. It has advantages and disadvantages. All things being equal, I prefer company-owned vehicles; but, if employe-owned service is established upon a proper basis and can be used for certain needs at an appreciable saving, it deserves our interest and consideration.

PHILADELPHIA UNCHALLENGED IN "GET-YOUR-MAN" CAMPAIGN

IN THE monthly process of accumulating the figures in the Get-Your-Man Campaign, it has been interesting to watch the relative positions of the Sections and individuals contending for the various awards, and now and then to hazard a guess as to the possible outcome. Last month it seemed that the position of the leading Section would be challenged by one, and possibly two, of the Sections. However, this has not been the case, and Philadelphia stands at the head of the list with more than 50 per cent of its quota obtained in new members, elected and qualified.

However, according to present indications, next month will probably "tell the tale" for it may be possible to announce the winners in the campaign. What will the standing be then? Remember the proverbial last-minute "grand rush"!

In the tabulation of Section standing given below it will be noted that Indiana is holding tenaciously to second position with 39.2 percentage of its quota elected and qualified, and that the Canadian Section has jumped over Baltimore with a percentage of 34.6. Noticeable, too, is the fact that Detroit has passed Metropolitan by a small margin.

SECTION STANDING
(Expressed in Percentage of Quota)

Philadelphia	51.4
Indiana	39.2
Canadian	34.6
Baltimore	32.8
Northwest	31.2
Southern California	29.0
Detroit	22.5
Metropolitan	21.2
Chicago	19.5
Pittsburgh	18.6
Kansas City	16.6
Washington	14.0
Cleveland	12.3
Syracuse	12.1
Wichita	11.8
Buffalo	10.5
St. Louis	9.7
Northern California	9.0
Dayton	8.1
New England	7.8
Milwaukee	7.1
Oregon	0.0

The standing of individuals contending for the various awards is as follows:

INDIVIDUAL STANDING
(For Individual Awards)

First Place
John F. Hardecker

Tied for Second	*Tied for Third*
R. N. DuBois	H. M. Jacklin
L. M. Porter	C. C. Mathis

Tied for Fourth Place

A. Gelpke	L. R. Joslin
F. K. Glynn	Reese Lloyd
C. H. Jacobsen	L. V. Newton

Tied for Fifth Place

George B. Allen	B. J. Lemon
John G. Holmstrom	G. O. Pooley
R. N. Janeway	C. C. Stewart
P. J. Kent	R. R. Tector

O. M. Thornton

There is still time for some of the applicants to qualify by payment of initiation fee and dues, and this next month should be a busy one for contending sponsors. Information will be gladly given to sponsors regarding the standing of their applicants upon request to the New York City office.

FELLOWSHIP

IT HAS been aptly said by one of our good members that while the S. A. E. is primarily a professional and technical organization, in reality it is a cooperative group of engineers. This is splendidly borne out by the manner in which the membership of the Society has rallied to the aid of that portion of our membership that has been adversely affected by present economic conditions.

This month finds the Metropolitan and Philadelphia Sections added to the list of those actively and intensively working in the interest of their unemployed members. In a previous issue, mention was made of the activity of the Chicago and Southern California Sections and the fine results obtained. Detroit has regularly pushed the placement of members forward, and now practically all of the Sections are carrying on this laudable work.

If you are employed and know of an opening in your own or any other organization, or if you hire men or know of an opportunity anywhere for a fellow member, get in touch with your Section office by telephone or the S. A. E. Employment Service at the New York City office. Bulletins will be sent upon request.

In truly S. A. E. fashion—

REMEMBER A MEMBER!

Technical Engineering Editors	Aircraft Designers
Transportation Engineers	Sales Engineers
Diesel-Engine Designers	Body Designers
Production Engineers	Metallurgists
Aircraft-Engine Designers	Chief Inspectors
Passenger-Car Designers	Stress Analysts
Transmission Designers	Truck Designers
Executive Engineers	Draftsmen

REPORTS OF COMMITTEES

MEETINGS COMMITTEE REPORT

Eight general meetings of the Society were held between Feb. 1, 1932, and Jan. 31, 1933.

Total attendance at these eight general gatherings fell but little short of the total for the preceding year, despite continued deceleration of general business and increasing unemployment in the ranks of automotive engineers. The number present in a few instances, notably the Semi-Annual or Summer Meeting, showed a marked decrease, but increases in other gatherings came close to offsetting specific declines.

This accelerated pulling power of S.A.E. technical sessions, which was evident relatively in practically every meeting where expense of attendance was not a dominating factor, is due unquestionably to the careful planning and vigorous execution of timely programs by the Meetings Committees of the eight Professional Activities. It is significant of the vitality of Society activity in depression times that the 1932 Annual Meeting was the largest single gathering in attendance ever held by the Society.

Acting almost wholly as a coordinating and supervisory agency, the general Meetings Committee is depending more and more every year on the individual initiative of the Professional Activity Meetings Committees in the development of session programs. The soundness of this policy, begun with the adoption of the revised Constitution of the Society three years ago, was demonstrated forcibly again in the year just passed. Controversy and comment, the standard measuring sticks of meetings' effectiveness, reached a high point in volume, intensity and informativeness which had not been attained since the days of the four-wheel-brake and balloon-tire arguments of 1923.

This striking virility in technical sessions was achieved despite an increase in the average of papers per session from 1.87 in 1931 to 2.13 in 1932, a real tribute to the selection of topics by the Activity Meetings Committees and to the vigor of presentation of the average 1932 paper.

As always, the general Meetings Committee has the active cooperation of individual Sections to thank for the practical success of individual meetings. The part played by the Cleveland and Detroit Sections in carrying out the Aeronautic Meetings; by the Canadian Section in staging the Transportation Meeting; by the Buffalo Section in handling the Production Meeting; and by the Detroit Section in making successful the Annual Meeting—in every instance was definitely vital. And the Motorboat Meeting was almost completely the handiwork of Metropolitan Section members.

Both Aeronautic Meetings held during the year were staged in conjunction with the Aeronautical Chamber of Commerce of America; and at the Production Meeting, held concurrently with the National Metals Congress and National Metals Exhibit, a luncheon was staged jointly by the American Society of Mechanical Engineers and our Society.

The Summer Meeting at White Sulphur Springs was high in value, although low in attendance; while the Annual Dinner, the Society's sole social function of the year, was marked by an enthusiasm which duplicated that of the most successful Dinners of the past. Attendance equaled that of the 1932 dinner.

Owing to the intimate and vigorous helpfulness of every group of Society members, the general Meetings Committee can report that 1932 was a year of most successful meetings.

NORMAN G. SHIDLE,
Chairman.

MEMBERSHIP COMMITTEE REPORT

In the last year the Membership Committee has been very active and the Get-Your-Man campaign produced excellent results. Over 400 applications were received as a direct result of this work and approximately three-quarters of these applicants have become members of the Society up to the close of this last year.

The following membership statistics are presented to show the details for 1932 as well as the comparative figures for 1931:

MEMBERSHIP BY GRADES FOR THE YEARS ENDED DEC. 31

	1932	1931
Members	3,450	3,487
Associates	2,087	2,205
Juniors	573	604
Foreign Members	317	302
Service Members	117	99
Departmental Members	1	1
Affiliate Members	95	99
	6,778[a]	6,938
Affiliate Member Representatives	138	141
Enrolled Students	213	281
Grand Total	7,129[a]	7,360
Applications for Membership Received	640	566
Percentage of Applicants Qualifying	63	81

[a]Includes members placed on the Temporarily Inactive List.

The Committee wishes to express its sincere appreciation to the members and the Sections who have worked so diligently throughout the year to help maintain the membership in the Society.

ALEX TAUB,
Chairman.

MEETINGS OF THE SOCIETY OF AUTOMOTIVE ENGINEERS, FEBRUARY, 1932, TO JANUARY, 1933

Meeting	Location	Date	No. of Sessions	No. of Papers
		1932		
Motorboat	New York City	Feb. 18	1	4
Aeronautic	Detroit	April 5 to 7	7	14
Semi-Annual	White Sulphur Springs, W. Va.	June 13 to 17	10	21
Aeronautic	Cleveland	Aug. 30 and 31	4	8
Production	Buffalo	Oct. 3	2	5
Transportation	Toronto	Oct. 4 to 6	8	18
		1933		
Annual Dinner	New York City	Jan. 11	1	2
Annual Meeting	Detroit	Jan. 23 to 26	15	30
			48	102

PUBLICATION COMMITTEE REPORT

With the cooperation of members of the various Activities Committees, the best and most timely of the papers presented at meetings were published in THE JOURNAL during the past year. The elapsed time between their presentation and publication was reduced and all of the activities of the Society were reported as adequately as possible. During the calendar year 808 pages of text and 450 pages of revenue advertising were published in THE JOURNAL. Of the text pages, 492, or approximately 61 per cent, consisted of papers and discussion. Sixty-seven complete papers, some with discussion, and 10 discussions printed separately were published during the year.

An important innovation was the bringing out of THE JOURNAL regularly each month on the last day of the preceding month or the first day of the month of issue, with exception of the February and July issues, which were delayed a few days to get into them the full reports of the Annual and Semi-Annual Meetings.

Beginning with the January, 1933, issue, a new cover design was adopted for THE JOURNAL and is to be used on all issues of the year. Also a change in typography was instituted to improve the appearance of the text pages.

Transactions

TRANSACTIONS of the Society were brought up to date by the publication about the middle of the year of Vols. 25 and 26, for the years 1930 and 1931, combined in one book of 676 pp. bound in flexible covers. Vol. 25 contains 47 papers and Vol. 26 contains 49 papers, all very carefully chosen for their technical information and their value for reference purposes. Of the 96 papers in the two volumes, 6 are classified as passenger-car research and design, 16 as engine research and design, 5 as oil engine, 5 as chassis parts, 29 as fuel and oil research, 8 as aircraft, 11 as aircraft engine, 6 as production, 3 as motor-truck and motorcoach, 6 as operation and maintenance, and 1 as motorboat papers.

Beginning with the January, 1932, issue, papers and discussion were printed in forms separately from the departmental and news forms and a sufficient number of copies of these forms in excess of those required for the issues of THE JOURNAL were printed each month for binding into a volume of TRANSACTIONS for the year. Thus, all the papers and discussion printed in the 12 issues of the S.A.E. JOURNAL last year were ready on Dec. 1 for gathering and binding in Vol. 27 of TRANSACTIONS. This makes possible the bringing out of TRANSACTIONS for 1932 as soon as the index can be compiled and printed and the volume bound.

Vols. 25 and 26 were distributed free to members upon request; for Vol. 27, covering 1932, the Council voted to make a charge of $2 to members requesting the volume, the charge to be entered upon the bill for annual dues.

Handbook and Roster

The S.A.E. HANDBOOK of standards for 1932 was published in the form of supplements to the 1931 HANDBOOK, one a small paper-bound volume in January, covering new and revised standards and recommended practices adopted by the Society in May, 1931, and in January, 1932, and the other in the form of stapled perforated sheets issued in July, including additions and changes adopted in June, 1932, to be detached

and pasted in their proper places in the 1931 HANDBOOK. This procedure resulted in a considerable saving of expense.

The S.A.E. Roster for 1932 contained 126 fewer pages than the 1931 Roster, this saving being effected by omitting the Geographical Register (62 pp.) and condensing the Alphabetical Register and the Company List by abbreviating titles. All the other information contained in the Roster for former years was retained. The 1932 Roster showed a total of 7238 members, including Affiliate Members, Affiliate Member Representatives and Enrolled Students. This total compared with 7431 in January, 1931.

The Roster for 1933 will be issued about the middle of February and will be similar in all respects to last year's book.

D. BEECROFT,
Chairman.

RESEARCH COMMITTEE REPORT

At the close of a year in which business charts almost without exception have shown a nose-dive trend, it is a pleasant duty to record the definite progress and noteworthy gains made in the Society's research work; this in spite of very limited funds available and the necessity for keeping meetings and attendant traveling expenses of committee members at the minimum.

Detonation

Again the accomplishments in detonation research claim a place in the forefront of the Cooperative Fuel-Research activities. The need for correlating the results of knock ratings of fuels made in the laboratory with actual detonation behavior of these fuels in automobiles on the road was noted in the last report. Toward this end an intensive program of cooperative road tests was conducted on Uniontown Hill in Pennsylvania during August, 1932, followed by a series of laboratory tests at the plant of the Waukesha Motor Co., in Waukesha, Wis.

To bring the laboratory method in line with road evaluation of a fuel, a definite technique of road test was evolved that, while not to be considered in commercially determining octane numbers, was regarded by the Committee as sufficiently accurate and reproducible to serve as the first step in the development of a satisfactory laboratory method.

With a satisfactory road-test method available, the next step was to test a representative group of fuels and then develop a laboratory method which closely approximates the road results. The method finally adopted, a logical outgrowth of the original procedure, evolved by modifications consistent with the development as originally contemplated, meets this requirement with an extremely close approximation of road observations. This revised procedure was formally adopted by the Cooperative Fuel-Research Steering Committee, to become effective not later than Jan. 1, 1933, under the title, C.F.R. Motor Method.

A comprehensive report of the present status of the detonation research work will be presented at the 1933 Annual Meeting in a paper by C. B. Veal, H. W. Best, J. M. Campbell and W. M. Holaday.

Vapor Lock

Previous research reported on vapor lock has related the normal bubble point of the fuel to the Reid vapor pressure and the 10-per-cent point on the American Society for Testing Materials distillation curve.

Surveys have also been made of temperatures in the fuel systems of a number of representative automobiles. The results of these surveys have broadly indicated that vapor lock would be expected on a number of cars operating on certain commercial gasolines with the atmospheric ranges to be expected under normal weather conditions. However, the fuel used for these determinations was deliberately chosen so that vapor lock should not occur during the running of these tests, and no road work relating the actual occurrence of vapor lock with the predicted occurrences had been systematically conducted until last spring, when a program of work was undertaken to correlate predicted vapor-lock values with the actual occurrence of vapor lock in the automobile and to investigate the causes of any discrepancies between the actual and the predicted values.

The program, which has been made possible through the financial assistance of the Natural Gasoline Association, was planned to cover a period of one year so as to include all weather conditions and temperatures. A report on the portion of the work completed to date will be given in the paper by O. C. Bridgeman, H. S. White and F. B. Gary, scheduled for presentation at the 1933 Annual Meeting.

About a year ago the Cooperative Fuel-Research Steering Committee requested that the Bureau of Standards extend its vapor-pressure work to include automotive Diesel fuels while the vapor-pressure apparatus was still available. A preliminary report was presented by Miss E. W. Aldrich at the 1932 Summer Meeting.

Gum in Gasoline

The gum-research program, adopted by the Cooperative Fuel-Research Committee about a year ago, consisted of three phases:

(1) The development of a method for the determination of the gum content of gasolines which is significant as regards gum deposition in the engine

(2) Investigation of the effect of engine-design factors on gum deposition in the engine

(3) Development of a method for the determination of the gum stability of gasolines

About one-third of this investigation has been completed. A paper entitled Effect of Temperature on the Determination of Gum in Gasoline, by O. C. Bridgeman and J. C. Molitor, was presented at the 1932 Semi-Annual Meeting.

Due consideration has been given to correlating the results of this work with the service tests that are being conducted under the direction of a technical committee of the American Society for Testing Materials with a view toward developing universally satisfactory standard test methods.

Lubricants Research

Substantial progress was made during the year by the Lubricants Research Subcommittee formed in the latter part of 1931 to develop tests to evaluate the properties of extreme-pressure lubricants and determine the lubrication requirements of gears and bearings, with the idea of correlating the tests on the oils with the requirements of the gears and bearings.

At the outset of the project it was agreed that the general problem should be studied under the following subheadings:

(1) Load-carrying capacity before seizure
(2) Tendency to cause wear or abrasion
(3) Corrosiveness
(4) Stability, both in storage and in service

Since other properties of extreme-pressure lubricants are of no interest if the lubricants have not the desired load-carrying capacity, the Subcommittee suggested that the Bureau first undertake the development or standardization of a method for the measurement of load-carrying capacity.

A group of lubricants were chosen as representative of the various types of extreme-pressure lubricant, and comparative tests of these were made on a number of available machines. The results of this research are covered in the report entitled The Load-Carrying Capacity of Extreme-Pressure Lubricants, scheduled for presentation at the forthcoming Annual Meeting by S. A. McKee.

This research has been financed by individual-company contributions, jointly and in approximately equal portions by the automotive and allied industries and the petroleum industry. The following companies were among the subscribers to the research fund for the last year, and most of them have indicated their willingness to continue their support for another year's work:

Petroleum Products Manufacturers

Battenfeld Grease & Oil Corp.
Henry L. Doherty & Co.
Fiske Brothers Refining Co.
Gulf Refining Co.
Metasap Chemical Co., Inc.
Shell Petroleum Corp.
Sinclair Refining Co.
Standard Oil Co. of California
Standard Oil Co. (Indiana)
Standard Oil Co. (Ohio)
Standard Oil Development Co.
D. A. Stuart & Co.
Sun Oil Co.
The Texas Co.
Tide Water Oil Co.
Union Oil Co. of California
Vacuum Oil Co.

Motor-Car Manufacturers and Allied Industries

Chrysler Corp.
Cleveland Worm & Gear Co.
Columbia Axle Co.
Eaton Mfg. Co.
General Motors Corp.
Gleason Gear Works
Hudson Motor Car Co.
Nash Motors Co.
Packard Motor Car Co.
Timken-Detroit Axle Co.
Timken Roller Bearing Co.
(One contributor does not want the company name listed)

Headlighting

The paper entitled What Can Be Seen with Headlights, presented by H. C. Dickinson at the 1932 Semi-Annual Meeting, constituted a final report of the headlight research work conducted at the Bureau of Standards under the technical guidance of the Headlight Subcommittee with funds provided by the National Automobile Chamber of Commerce. This report is a significant chapter in a long story of headlighting research, which was one of the first problems taken over by the Society's Research Committee upon its formation.

The major portion of the Subcommittee's efforts was devoted to enlisting the cooperation of motor-car and lamp manufacturers in a fundamental study of light distribution. Many difficulties arose in coordinating the results of these diversified investigations and it was felt desirable to undertake a program of research in a centralized laboratory under the general direction of the Subcommittee. Accordingly, with funds provided by the National Automobile Chamber of Commerce, work was initiated at the Bureau of Standards, and this investigation by road test, supplemented by laboratory ex-

periment, was directed toward determining the optimum light distribution under various road conditions, at the same time protecting approaching drivers from glare. Progress reports have been rendered from time to time and a résumé of the entire project was included in the Semi-Annual Meeting paper referred to above[1].

In the discussion of this report at the Headlight Subcommittee meeting, general agreement was reached that only a limited range of beam intensity should be permitted, with no absolute limits on the maximum intensity, and, further, that regulations should apply to all cars on the road and not exclusively to the new cars being produced.

Highway Research

As a result of the activity of the National Conference on Street and Highway Safety, the Bureau of Public Roads was assigned to undertake a research program on traffic, and the Research Committee of the Society was invited to offer suggestions concerning phases of the problem to be included. Accordingly, previously published traffic studies were reviewed by individual members of the Subcommittee, a series of informal meetings held, and research problems outlined under the general heading of Highway Utilization. These were submitted to the Transportation Division of the Bureau of Public Roads as suggestions for future work.

Further discussion of this outline resulted in the recommendation of the Subcommittee that it be submitted also directly to some of the State motor-vehicle administrators. The outline comprises three main divisions: *(a)* The Highway, *(b)* The Vehicle and *(c)* The Driver; but the Subcommittee agreed that the third division, although important, is outside its field.

The Highways Subcommittee has also continued its cooperation in the impact-test work done by the division of tests of the Bureau of Public Roads, a progress report of which appears in the November, 1932, issue of *Public Roads* under the title, Road Impact Produced by a Heavy Motor Bus, by James A. Buchanan.

The Subcommittee began this work and recommended that the Research Committee offer assistance to the Bureau in the development of instruments for the estimation of road roughness in connection with the problem of determining where and when repairs are economically justified.

Front-Wheel Alignment

Since the Front-Wheel-Alignment Session at the 1932 Annual Meeting, at which concluding reports were presented covering the findings in the wheel-alignment survey, the Subcommittee has reached agreement on several supplementary items.

The recommendation of one standard of wheel-alignment settings is not possible nor practicable at present, the Committee members feel. Nor is it practicable to recommend one method and one type or make of instrument for measuring alignment. At the last meeting of the Subcommittee, it was considered more advisable for each manufacturer to establish his own procedure. The Society was requested to suggest to the National Automobile Chamber of Commerce that that organization undertake the yearly collection of wheel-alignment data, together with all other specification data, and act as a clearing-house of such information for distribution to trade journals. All inquiries for such data could then be directed to the N.A.C.C., the data being supplied to that body on a standardized form as each new model of car is produced. Further activities of the Front-Wheel-Alignment Subcommittee will be determined at the forthcoming meeting.

[1]See S. A. E. JOURNAL, August, 1932, p. 339.

Riding Comfort

Dr. F. A. Moss has been continuing the tests on subjects with the wabblementer, audiometer, visiometer, the recently developed reaction-time instruments and the test for CO_2 combining power of the blood, together with such other tests as the progress of the work had shown to be desirable. He will present a comprehensive and correlated report covering the different instruments and methods for the measurement of fatigue induced by automobile riding at the Riding-Qualities Session of the 1933 Annual Meeting.

B. B. BACHMAN,
Chairman.

SECTIONS COMMITTEE REPORT

The manner in which the Sections have carried on during the first half of their administrative year 1932-1933, and the indications at hand of their proposed activities for the remainder of the Section year, might well serve as a yardstick of their apparent health and stability in spite of reduced budgets and consequent retrenchment in operating expenditures. In several instances a broadening of activities has occurred. Notable among these progressive steps is the group-meeting idea that has been worked by the Detroit Section with great favor. The new Marine Activity of the Metropolitan Section is another case of a successful venture into a new sphere of endeavor.

No change has occurred in the number of regular and probationary Sections since submission of the last report in June, 1932, there being 20 regularly constituted Sections and 2 probationary groups—Kansas City and St. Louis.

Student Branches

The five Student Branches of the Society at New York University, Massachusetts Institute of Technology, University of Detroit, General Motors Institute of Technology and Ohio State University are meeting regularly and, with the exception of the Branch at Ohio State University, are in close contact with the Sections nearest them, meeting jointly with the Sections and participating in the Section meetings.

Section Meetings

According to the records, 89 Section meetings have been held up to and including the month of January, 1933, at which 89 speakers presented papers on subjects as listed below:

General Subject	*No. of Papers*
Aeronautic	14
Bodies	1
Diesel Engines	2
Marine and Marine Engines	4
Passenger-Cars	12
Powerplants and Fuels	25
Production	1
Tires	7
Transportation and Maintenance	17
Trucks and Motorcoaches	2
Tractors	4

Of the 89 meetings, 3 not included in the above tabulation were in cooperation with general meetings of the Society, 2 were special student meetings, 6 took the form of inspection trips, and 21 were of a general character on the subjects of insurance, highways and taxes, patents, electricity, safety in traffic, mechanical refrigeration, military automotive developments, and materials such as iron and steel, glass, aluminum and lacquers.

An interesting fact is that in the majority of Sections the increase in the number in attendance at meetings has been noticeable. This is particularly outstanding in the cases of the Cleveland, Detroit, Milwaukee, Philadelphia, Southern California and Syracuse Sections.

With the beginning of the Section year last September, the Detroit Section inaugurated a new plan whereby simultaneous sessions of each activity sponsored by the Section are held each month, the entire body meeting at dinner and then dispersing in interested groups to their particular activity sessions.

Employment Service

In an endeavor to do as much as possible for those of our members who are unemployed, a letter was sent early in the year to each Section calling attention to the work of the Employment Service of the Society and urging local cooperation in this very laudable service. The manner in which the Sections have responded is very heartening. So far, nine Sections have appointed Employment Committees to take over this work, and the Chicago, Metropolitan, Philadelphia and Southern California Sections are actively engaged in employment work in their own territories. The slogan is "Remember a Member," and it is felt that, with the excellent cooperation of these Sections, much good will result in the effort to do all that is possible for the unemployed members of the Society.

Membership Activity of the Sections

Similarly, plans are afoot to enlist the Sections in increased local membership activity, it being felt that local personal contact in the case of delinquent members and those showing inclination to resign will do much to forestall a possible drop in the membership figures of the Sections and the Society.

Participation in Get-Your-Man Campaign

The enthusiasm with which the Sections entered into the Get-Your-Man campaign, which was instituted in February, 1932, and the spirit in which the work was sustained throughout the period of the contest have had much to do with the success of this undertaking. At the outset of the campaign, quotas were assigned to the Sections based upon the membership of the Sections at that time and the potentialities of the Sections as indicated in their territories, and there has been much friendly rivalry in competition for the various awards.

In retrospect, there is every evidence of increased activity in the Sections, larger meeting attendance in the majority of cases and a demonstrated ability to carry on creditably under adverse conditions. This is unmistakable evidence of the interest of the Section officers in the welfare of their Sections and of the cooperation of local members in their local bodies.

RALPH TEETOR,
Chairman.

STANDARDS COMMITTEE REPORT

Ten Division and five Subdivision meetings, aside from the meetings of the Standards Committee last June and this January, were held in the last year where the work required. However, most of the work of the Divisions has been done by correspondence.

Division Reports

Of about 27 reports submitted during the year by 11 Divisions, 10 were new subjects, 15 were revisions of existing standards and 2 were cancellations of obsolete standards. The Divisions reporting during the year were the Air-

craft, Ball and Roller-Bearing, Electrical Equipment, Gasoline Engine, Iron and Steel, Lighting, Lubricants, Motorcoach and Motor-Truck, Non-Ferrous Metals, Parts and Fittings, and Screw-Threads.

Special Committees

The only special committee directly concerned with the Standards Committee that was active during the year was the Standardization Policy Committee. Early in 1932 this Committee completed the new Standards Committee Regulations, under which improvements were made in the Standards Committee organization and the general procedure so changed that reports can be finally approved and adopted at almost any time in the year instead of only at the Annual and Semi-Annual Meetings of the Society, as previously. The cooperation of the Society in projects under the procedure of the American Standards Association has already been expedited under the provisions of the new Regulations, which were printed in the July, 1932, Supplement to the S.A.E. Handbook.

The Policy Committee also prepared recommendations, subsequently approved by the Council, for participation by the Society in the international standardization of tires and rims with the cooperation of the Tire and Rim Association.

Three other committees concerned with standardization were active during the year. The Automotive Transport Code Committee had prepared recommendations on engineering requirements for a uniform code for State motor-vehicle regulation.

The Motorcoach and Motor-Truck Rating Committee continued its work last year and recommended a definite method for rating motor-trucks that is to be tried out by the motor-truck manufacturers before it is submitted to the Society for adoption as a standard.

Sectional Committees

Sponsorship for 10 Sectional Committees and membership on 19 others under the procedure of the American Standards Association, as reported last January, have been continued. During the last year, joint sponsorship with the American Society of Mechanical Engineers was taken and a new Sectional Committee organized to prepare standards for the determination or classification of surface qualities with respect to the kind and finish of surface of various materials used in manufacture. The S.A.E. also appointed representatives on three new Sectional Committees, concerned with acoustical measurements, foundry equipment and supplies and preferred numbers.

International Standardization

Several reports of the Sectional Committee on Ball Bearings were approved by the Society as a sponsor, and the Society was represented at international conferences on automobile, aircraft and antifriction-bearing standardization that were held at Milan, Italy, last May. S.A.E. membership in the International Standards Association Committee 31 on tires and rims has been approved by the Council.

General Activities

The Society has continued its active representation on about 30 committees and technical standardization in engineering and industrial groups of other organizations concerned with fields. General interest in standardization on a national scale is continuing to grow in this Country, and progress is being made very rapidly in international organization for world standards, so that greater progress than ever undoubtedly will be made in these fields when world economic conditions return to normal. The automotive industry is very much concerned with all of these activities, and the S.A.E., as representing the American industry, should maintain an important and active participation in them as well as carrying on the standardization in the automotive industry.

COMPARATIVE BALANCE SHEET AS OF SEPT. 30, 1931, AND SEPT. 30, 1932

Assets	1932	1931
Cash	$ 14,843.70	$ 13,647.93
Accounts Receivable	10,313.85	19,717.20
Securities	199,871.50	219,271.50
Accrued Interest on Securities	3,147.08	3,534.58
Inventories	780.25	775.45
Furniture and Fixtures	6,900.71	7,465.03
Items Paid in Advance, Charges Deferred	5,727.74	6,368.31
Total Assets	$241,584.83	$270,780.00
Liabilities and Reserves		
Accounts Payable	$ 9,643.44	$ 7,945.45
National Dues and Miscellaneous Items Received in Advance	9,859.89	19,253.37
Reserves Set Aside for Anticipated Expenses	8,860.15	2,624.04
General Reserve	240,957.14	241,607.21
Net Unexpended Income	27,735.79[a]	650.07[a]
Total Liabilities and Reserves	$241,584.83	$270,780.00

[a] Deficit.

S.A.E. Handbook Supplement

The January, 1932, general Supplement to the 1931 S.A.E. Handbook contained all of the new and revised specifications adopted by the Society since January, 1931. The July, 1932, Supplement was issued following the Semi-Annual Meeting as in previous years and contained the new and revised specifications that were adopted last June.

A. Boor,
Chairman.

TREASURER'S REPORT

During the 1931-1932 fiscal year there has been the fullest cooperation between your Council, the office staff and your Finance Committee in efforts to maintain the essential activities of the Society at the minimum cost in the face of the continued reduction of practically every source of the Society's income.

As a result of this cooperation, the total expenses have been held to $257,228.71, which is $47,569.29 under the budget and, in turn, was $38,000.00 under the previous year's expenses; that is to say, the total expenses of the Society have been $85,614.58 less during the last fiscal year than during 1930-1931 and $163,121.66 less than during 1929-1930, all of which your Treasurer feels is a very creditable showing considering the excellent character of work that has been maintained.

Despite excellent cooperation and much intensive work, it has been found impossible to keep pace with declining income, resulting in a red net unexpended income of $27,735.79 compared with $650.07 last year. It may be noted in passing that the protection of this kind of a situation is one of the purposes of the surplus fund as represented by our securities account. Obviously, however, such inroads cannot be continued indefinitely, so that, unless the Society's income soon starts upward again, further readjustments will be necessary.

For further details, please note the accompanying statements of Comparative Balance Sheet and Income and Expense Accounts.

C. W. Spicer,
Treasurer.

INCOME AND EXPENSE AND BUDGET COMPARISON FOR 12 MONTHS ENDED SEPT. 30

Income	1932	1931	Budget
Dues and Subscriptions	$ 83,849.75	$109,017.35	$ 90,000.00
Initiation Fees	8,745.00	14,070.00	14,000.00
Interest and Discount	10,417.66	11,081.22	11,000.00
Advertising Sales—S.A.E. Journal	107,145.00	182,595.00	162,650.00
Advertising Sales—S.A.E. Handbook	2,750.00	6,000.00	5,000.00
Miscellaneous Sales	13,377.72	15,229.40	15,000.00
Profit from Sales of Securities	93.25	87.75	.....
Unused Portion of Section Dues	3,114.54	4,112.50	.....
Total Income	$229,492.92	$342,193.22	$297,650.00
Expense			
Research	$ 12,381.03	$ 13,325.36	$ 13,296.00
Standards	8,959.67	12,824.78	11,185.00
Publications	65,063.79	93,139.08	73,550.00
Sections	8,725.55	16,285.07	10,490.00
Meetings	24,232.82	36,488.49	33,465.00
Professional Activities	263.36	791.70	1,150.00
Cost of Membership Increase	12,268.11	11,557.88	10,900.00
Cost of Advertising Sales—S.A.E. Journal	34,081.80	51,978.74	50,190.00
Cost of Advertising Sales—S.A.E. Handbook	390.61	1,346.24	1,300.00
Cost of Miscellaneous Sales	4,904.08	6,008.65	5,955.00
General Expense	85,957.89	99,097.30	93,317.00
Total Expense	$257,228.71	$342,843.29	$304,798.00
Net Unexpended Income	27,735.79[a]	650.07[a]	7,148.00[a]

[a] Deficit.

PERSONNEL OF S.A.E. COMMITTEES FOR 1933

PRESIDENT DICKINSON announced at an organization meeting of the 1933 Council, held in Detroit in January, his appointments on the Administrative Committees of the Society and the personnel of the Professional Activities, Technical and Special Committees for 1933, as given herewith. These include the Research Committee and its Subcommittees, the Standards Committee and its Divisions, the Society's Special Committees and Cooperative Committees on which the Society is represented with other organizations. Acceptance of their appointment has been received from virtually all of those named.

ADMINISTRATIVE COMMITTEES

CONSTITUTION COMMITTEE

F. E. Watts, *Chairman* (1 yr.)
B. B. Bachman (3 yr.)
W. J. Davidson (2 yr.)

FINANCE COMMITTEE

C. W. Spicer, *Chairman*
David Beecroft
C. L. Lawrance
B. B. Bachman
C. B. Whittelsey

HOUSE COMMITTEE

E. F. Lowe, *Chairman*
Harlow Hyde
G. O. Pooley
Howard Baxter
G. C. Stevens

MEETINGS COMMITTEE

Alex Taub, *Chairman*
A. L. Beall, *Vice-Chairman*
Carl Breer
F. C. Horner
M. A. Thorne

PROFESSIONAL ACTIVITIES REPRESENTATIVES

Aircraft	R. C. Gazley
Aircraft-Engine	C. L. Lawrance
Diesel-Engine	Julius Kuttner
Motor-Truck	L. R. Buckendale
Passenger-Car	Alex Taub
Passenger-Car-Body	A. J. Neerken
Production	J. Geschelin
Transportation	L. V. Newton

SECTION REPRESENTATIVES

Baltimore	G. E. Hull
Buffalo	K. M. Wise
Canadian	N. B. Petersen
Chicago	Curtiss Stewart
Cleveland	William Piwonka
Dayton	E. C. DuVal
Detroit	Vice-Chairmen
Indiana	Lee Oldfield
Kansas City	R. J. Collins
Metropolitan	C. H. Baxley
Milwaukee	C. M. Eason
New England	G. S. Whitham
Northern California	S. B. Shaw
Northwest	Sherman Bushnell
Oregon	H. W. Drake
Philadelphia	Leslie Peat
Pittsburgh	F. W. Heisley
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J. M. Watson

Committee A7 on Malleable Castings

H. T. Chandler

Committee B6 on Die-Cast Metals and Alloys

W. S. Howard

Committee D2 on Petroleum Products and Lubricants

H. C. Mougey

Committee D11 on Rubber Products

F. C. McManus

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J. B. Johnson

Joint Committee on Investigation of the Effect of Phosphorus and Sulphur in Steel

F. P. Gilligan

Special Committee on General Use of Specifications for Copper Alloys in Ingot Form

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NATIONAL SCREW-THREAD COMMISSION

Earle Buckingham
G. S. Case

PRESSED METAL INSTITUTE

Steel Research Committee

Rodney Horton

HIGHWAY AND BUILDING CONGRESS

(*Concluded from p. 35*)

in securing regulation that will provide the best and most economical transportation of persons and goods.

Recommendations Voted at Meeting

In closing this session of the American Road Builders' Association Convention, which was conducted jointly by the Motor Truck Executives of America and the Transportation and Maintenance Activity of the Society, the following were in effect voted as the recommendations of this meeting:

(1) To amend the vehicle license tax laws so that they will provide only for vehicle registration, certificate of title, and police service, and shall not be used as a means of raising funds for road construction or maintenance

(2) As it costs no more to issue registration plates and certificates of title and to police a 5-ton truck than it does for the same service on a light passenger-car, that there be a flat registration fee for all classes of vehicle sufficient to provide the cost of administering the registration, certificate of title and police departments

(3) As the gasoline tax is the most equitable measure, for all classes of vehicle, of road miles used and of vehicle destructibility to roads, and because the gasoline tax is the most economical in cost of collection and most acceptable to the taxpayers, that there be a gasoline tax sufficient to meet the desires of the various States in their road-building campaigns, and that this gasoline tax be made as nearly uniform throughout the States as possible

NEWS OF THE SECTIONS

THE annual Automobile Show Dinner of the Metropolitan Section was held Monday evening, Jan. 9, in the grand ballroom of the Hotel New Yorker, with about 250 members of the Section and their guests present. As they filed into the ballroom, each was presented with a package of souvenirs, a feature of the Show Dinner that has become a permanent fixture which is looked forward to with anticipation. At each place was an emblem of the calling to which Ed Wynn is now bringing new honors in his weekly broadcast.

The dinner was a most enjoyable affair, in that the space available at the New Yorker enabled the members to circulate among the tables, renewing old acquaintanceships and forming new ones.

David Beecroft, a Past-President of the Society, was introduced as the Toastmaster for the evening by Section Chairman F. H. Dutcher. Mr. Beecroft first announced the distinguished guests at the speaker's table, including B. B. Bachman and Edward P. Warner, Past-Presidents of the Society; George Bauer, of the National Automobile Chamber of Commerce; and J. A. C. Warner, General Manager of the Society. The Toastmaster then introduced three visitors from overseas, who were in America to visit the automobile show and in other ways to bring themselves up to date on American automotive practice.

Dr. Jordan Speaks at Met Section Show Dinner Sees Hopeful Signs of Business Recovery Section Entertains Visitors from Overseas

Rowse Sees Economical Car Needed

A. A. Rowse, director and general manager of Morris Motors, Ltd., England, spoke about the effects of the depression upon the automotive industry in Great Britain and in the United States. He was very candid, saying that he felt that the engineers in the industry cannot do much more than accept the situation as it is and prepare production plans accordingly. He made the point that human beings have a craving for transportation, or, as it is often put in America, they "want to go places"; therefore, to expand the number of motor-car users in these times of depression, he thought it would be wiser to build cars to be not only low in first cost but low in cost of operation. England has had to face this problem for some years, he said. In his opinion the car that will meet the demands of the motoring public in the next few years, will be a little larger than the small cars of England and somewhat smaller than the average American car. His company is now producing a car designed for carrying four people, having a wheelbase of 96 in., powered by a 10-hp. engine, capable of doing 60 m.p.h. in reasonable comfort, and running approximately 30 miles to the gallon of gasoline.

Mr. Rowse expressed his conviction that the future of civilization lies in the hands of the English-speaking nations. He said that we frequently need adversity to make us see things as they really are, and that, if one of the results of this depression is to bring the great minds of America and Great Britain together for the good of civilization, posterity will have reason to be grateful that a depression existed.

Kettaneh Pictures Near-East Conditions

The second foreign visitor was F. A. Kettaneh, president of the Automobile Dealers Association of Syria, who spoke of the difficulties encountered in marketing and servicing automobiles in Persia, Syria and Iraq. One of his stories concerned a native priest, or "mullah," who had been assured that he would not have any special expenses in the way of car maintenance and who returned two days after delivery of his car to demand his money back, saying "You assured me I would have no further expense with my car and now my driver tells me he wants money to buy gasoline." Another story concerned a man who would not believe that a certain car was capable of delivering 18 hp. because he could not see the horses, but was very willing to accept the statement concerning the power of the car when he was induced to touch one of the spark-plugs while the engine was running.

Mr. Kettaneh said that in certain parts of his territory the automobile is still in competition with the camel, and that a camel with its driver can be hired for as little as six cents per day. However, the camel is being slowly supplanted by the motor-car and truck, and the rôle that is being left for the camel to play is more picturesque than real.

Difficulties encountered as a result of sand storms were mentioned, and Mr. Kettaneh said that the topography of the region is such that cars are operated from sea level to elevations as high as 11,000 ft. They start out with a temperature of 130 deg. fahr. in the shade and at the end of a journey may encounter freezing temperature. Nevertheless the motor-car is progressing in those countries because of the good service given in spite of being considerably overloaded and receiving little care.

André Dubonnet, president of Dubonnet Motors, of France, was introduced and gave a short description of the Dubonnet method of suspension, which was exhibited at the Automobile Show during show week.

Jordan Congratulates Industry on Courage

Dr. Virgil Jordan, president of the National Industrial Conference Board, Inc., the principal speaker of the evening, opened his remarks by stating that he believed the basis for substantial business recovery had been laid during the last year in the strong financial position that had been established in the United States through the inflow of gold, the return of currency from hoarding, and the banking reserves that had been accumulated. The present situation, he said, is in striking contrast to that of a year ago; the security market has been astonishingly stable for several months and the bond market reassuringly strong. Many difficult problems of readjustment remain to be met, but real progress toward recovery has been made and the prospect of further improvement is much more hopeful than a year ago. The one thing most necessary at the moment to speed the process of business recovery, he said, is the restoration to American industrial leaders of their self-confidence and a vigorous reassertion of the spirit of business enterprise that has characterized economic development in the past.

Dr. Jordan congratulated the automotive industry on its courageous resistance to the spirit of defeatism with which American industry as a whole has been surrounded. In expanding his subject, he emphasized the stupidities and distorted perspectives that place the blame for the present condition of the Country on first one set of reasons and then another, without stopping to see how any of these reasons could be wholly related to the results. He said that among all the clamoring, critical and sceptical voices of the time, the one voice that was conspicuously and strangely silent was that of American industry, yet this is the one voice that deerves to make itself heard and to have an influence in the discussions of national affairs.

Technocracy's Fallacies Pointed Out

Some of the fallacies in the present movement called Technocracy, Dr. Jordan pointed out, are its apocalyptic technological visions, its refusal to recognize the fundamental creative force of the individual human spirit and the steady drift toward economic and social decentralization. All this terrorism might be swept aside by the fundamental sanity of the American mind but for the alarming signs to be seen everywhere that the American people, and particularly its business men, have lost their mental balance. While there is no justification in any of the speculations of Technocracy regarding the future course of events in this Country, people are obviously eager to believe them and willing to take them at their face value, because faith in themselves has been shaken.

After the speaking program had been completed, Mr. Dunninger, of the National Broadcasting Co.'s Artists Bureau, presented an hour's entertainment. All who witnessed the performance were high in their praise of Mr. Dunninger's ability to present a most unusual type of entertainment. The members were mystified by having their own telephone numbers or automobile license numbers told to them, and on one occasion he even had one member tell another the four digits of his 'phone number. The program consisted of so many items of this sort that collusion was out of the question.

The meeting adjourned at 11:15 p. m.

SPEAKERS DESCRIBE THEIR CAR FEATURES AT WASHINGTON

Rival speakers listened with interest to the engineering offerings of competing companies at the meeting of the Washington Section on Jan. 18. Eight speakers, representing cars of 14 makes, each presented the 1933 features of their own make or makes.

Each speaker was allotted 10 min. per car, or slightly less if he covered two or three makes of similar character. The time was controlled by a traffic light at the back of the room. Green burned normally, yellow came on after four-fifths of the allotted time was used, and red when the time was up. About 75 attended the meeting.

The speakers were L. R. Colburn, sales manager of the Packard-Washington Motor Car Co., who covered Packard and Hudson-Essex; E. H. Smith, service manager of H. B. Leary,

Jr. & Bros., who covered Chrysler and Plymouth; C. H. Monahan, regional manager of the Studebaker-Pierce-Arrow & Rockne Sales Corp., who discussed these three makes of car; C. B. Amorous, vice-president of the Kempton Cadillac Corp., who talked on Cadillac and La Salle cars; E. W. Black, of the sales department of the Graham Motor Sales Co., who described the Graham; A. N. Bliven, service manager of the Nash Orr Motor Co., who covered the Nash; Tom Humes, district manager of the Byars Motor Co., of Charlotte, N. C., who covered the Austin; and H. S. Walsh, field technical instructor of the Chevrolet Motor Co. of Baltimore, who told of the new Chevrolets.

C. S. Bruce acted as Chairman and Dr. H. C. Dickinson, presidential nominee of the Society, was present.

BALTIMORE SECTION LAMENTS PASSING OF JOSEPH BAVETT

Upon the death on Jan. 4 of Joseph Bavett, superintendent of machinery of the Yellow Cab Co., of Baltimore, and a founder member of the Baltimore Section, the following resolution extending the sympathy of the entire membership of the Section was drafted and presented to Mr. Bavett's bereaved family by a specially appointed committee:

WHEREAS, God in His supreme wisdom has called away Joseph Bavett, our endeared friend and fellow member of the Society of Automotive Engineers, on this, the Fourth day of January, in the year of Our Lord Nineteen Hundred and Thirty-Three, and

WHEREAS, the deceased was one of the founders of the Baltimore Section of the aforementioned Society and officiated as its first executive secretary, and

WHEREAS, his tireless work for the advancement of the Society has won for him the high regard and affection of all who have known and worked wih him: always courteous, smiling and willing; unassuming and unopinionated, in spite of his experience of years, and at all times receptive to the ideas and thoughts of others; the methods he instituted in guiding the Section through the period of its infancy have been carried on, which is a tribute to his capabilities; therefore be it

Resolved, that on behalf of the entire Baltimore Section membership, we, the undersigned, a duly appointed committee, do hereby subscribe by our signatures to this resolution and extend to the family of our fellow member our sincere sympathy in the loss that is sustained; be it further

Resolved, that this resolution be spread upon the permanent minutes of the Baltimore Section, one copy thereof being conveyed to the family of the late Joseph Bavett and a second copy forwarded to the National Headquarters of the Society of Automotive Engineers.

W. H. BECK
A. B. BOEHM
ESPEY WILLIAMS, *Secretary*.

Mr. Bavett's whole business career was devoted to the taxicab business. He was born in Brooklyn, N. Y., in 1887 and received his technical education in mechanics at the Polytechnic School in Baltimore. From 1907 to 1909 he served the Red Taxicab Co., of New York City, as inspector, then for more than five years was foreman of mechanical work for the Yellow Cab Co., of New York City. His next connection was with the Black & White Cab Co., of the same city, for which he was superintendent of the mechanical department from 1916 to 1919. In the latter year he went to the company of the same name in Philadelphia in the same capacity, remaining until 1921, when he made his last change, that to superintendent of machinery for the Yellow Cab Co., of Baltimore.

Mr. Bavett was elected to Member grade in the Society in 1925, and, when the Baltimore Section was formed in 1930, was elected Secretary.

ALLOY-IRON DEVELOPMENT AND STEEL FAILURES EXPOUNDED AT SEATTLE

Determination of causes of steel failures and the development of high-test cast iron were kindred subjects discussed at the January meeting of the Northwest Section, held at the Bergonian Hotel in Seattle on the 6th. The meeting attracted the largest attendance in many months, 40 members and guests being present. Chairman Charles C. Finn, who presided in his usual efficient, jovial manner, announced that the February meeting will be devoted to welding and cutting as well as to the spraying of steel and other metals. He said that in March the topic will be the new Hedges two-way engine, which was developed in Seattle and is soon to be in production for a large truck-manufacturing company and for an outboard boat-engine manufacturer.

Why High-Grade Metals Fail

L. T. Holt, consulting metallurgist and engineer, of Seattle, presented the paper on Steel Testing at the January meeting. He said that until the development of metallography and physical metallurgy, the only method for solving the problem of the cause of failure of metal objects was by chemical analysis and the tensile-testing machine. When the results of these methods had been obtained and the cause was not proved, it was impossible to go further and the solution was left to speculation. The explanation often was, "It crystallized and broke." This statement was found conclusively to be absolutely wrong, said Mr. Holt; all the crystallization that occurs does so at the time of cooling.

Careful preparation of specimens to be tested for a metal failure is essential, Mr. Holt declared. This includes polishing, not merely burnishing, for the latter does not remove traces of the cutting saw or previous scratches. It is no exaggeration to say that the most important part of the mechanical operations in connection with micro work is the polishing. The greatest skill is demanded, and the production of satisfactory results requires long practice.

Lantern slides projected on the screen showed how cracking starts from rough contours and poorly finished metal. Examples of metal failures where no seizure had occurred and the material was of very high grade were displayed, showing the cause often to be due to non-metallic inclusions, such as slag-like silicates and sulphides. Steel makers aim to eliminate such inclusions as much as possible, but perfection is impossible to attain. The best steel must be treated the most carefully, Mr. Holt said in conclusion, or it will not live long, just as a high-spirited horse must be the most carefully groomed.

Progress Made in Alloy Iron

M. E. Greenhow, of the Washington Iron Works, traced the development and improvement of alloy iron during the last 15 years, real research for this purpose having started in 1916. The desire of producers was to obtain uniform composition and high tensile strength. This led to nickel, chromium and molybdenum irons being evolved. Progress was indicated, he said, by the fact that in 1923 only 11,000 lb. of nickel was sold to the cast-iron trade by the biggest nickel company, but in 1931 the total was 26,000,000 lb. Development was similar in the other iron alloys.

Both cupola and electric-arc-furnace methods were explained by the speaker, who stated that the latter method is superior, as its product wears better and is stronger because of the high heat of the electric arc.

Best results, asserted Mr. Greenhow, are obtained in the melting operations when the chemical composition is substantially as follows: The total carbon by the cupola process should be 2.75 to 3.00 per cent, while it may run 3.00 to 3.30 per cent by the electric-furnace process with equally good results; manganese in both cases is maintained within the limits of 0.80 and 1.00 per cent; sulphur always is kept as low as possible, and phosphorus as low as possible consistent with the type of casting being produced, the desirable maximum in any event being 0.25 per cent. Silicon is adjusted in proportion to the alloys used, so as to have the desired influence on the total carbon in maintaining a definite proportion between the combined and the graphitic carbon, consistent with the type of castings and their cross-sectional area. The best results in any case are dependent upon the iron being in a superheated condition when it is ready to pour.

Although the chemical elements contained in this type of iron are basically the same as in the cast iron of several decades ago, with the exception of the various alloy additions, there is a vast difference in the physical properties and structures, said Mr. Greenhow. The tensile strength has been increased from 18,000 to 22,000 lb. per sq. in. in the old irons to 50,000 to 65,000 lb. in the modern irons.

Mr. Greenhow, answering a question, stated that cylinder blocks today take more punishment than formerly and that the old blocks, if used under modern conditions, would crack. Another question elicited the information that the structure of the iron, rather than hardness as shown by the Brinell test, determines the life of the product. Distortion of the cylinder wall can be avoided by correct heat-treatment; however, if the temperature is again exceeded, distortion will follow.

In conclusion, Mr. Greenhow predicted still greater progress in steel and iron, with more advances to be made in the future than the past has known.

FLUID TRANSMISSION SYSTEM EXPLAINED TO CANADIANS

Members of the Canadian Section, gathered at the Royal York Hotel in Toronto on Jan. 19 for their regular monthly meeting, heard E. J. Cosford, president of the Associated Equipment Co. of Canada, Ltd., explain the construction and operation of the fluid transmission system as adopted by the parent company in England.

This system is comprised, Mr. Cosford said, of the Daimler fluid flywheel and the Wilson pre-selective transmission. The flywheel consists of a driving and a driven member, the former bolted to the engine shaft and having a number of cup-shaped pockets separated by radial webs formed on its inner surface. The driven member is of similar design and is free to rotate within the flywheel casing but is keyed to the transmission driving shaft. A small gap separates the cups and webs in the faces of the driving and driven members, and the flywheel is partly filled with an oil of low viscosity and high density. Rotation of the driven member causes the oil in its cells to flow toward their

periphery, then past the periphery of the cells of the driven member and through them to the inner circumference of the driving-member cells, establishing a circulatory motion. Momentum of the oil is imparted to the driven member, starting it rotating. When the latter attains full speed, the load on it causes it to lag behind the driving member, and, as the centrifugal forces in the latter are always greater than in the driven member, circulation is maintained.

At low engine speed, the slip can be 100 per cent at full-open throttle, with the transmission in gear and the car stationary. At usual car speeds, the slip is negligible, according to the speaker, who showed a slip chart on which a slip of 100 per cent occurs at 600 r.p.m. but drops rapidly to 15 per cent at 1250 r.p.m. under full-throttle operation, and then decreases almost uniformly to about 2 per cent at 3250 r.p.m. A dash line showed uniform slippage of 2 per cent in steady driving on a level road at all engine speeds from 1000 to 3250 r.p.m.

How the Planetary Transmission Operates

The transmission used with this fluid flywheel was developed in England by Major Wilson, of Improved Gears, Ltd., said Mr. Cosford, and was first applied commercially on the Wilson-Pilcher car. It is of the planetary type and has four forward speeds and reverse, a separate brake-band being applied to obtain each speed. A pre-selective lever and quadrant is mounted on the steering column below the steering-wheel, and the gear brakes are engaged by a main spring that is released by a change-speed pedal, depression of which disconnects the engine from the road wheels. The gears are selected by a camshaft, release of the pedal allowing the main spring to engage the gear selected.

RIDING-COMFORT AND SUPER-BALLOON-TIRE PAPERS PRESENTED AT PITTSBURGH

More than 115 members and guests of the Pittsburgh Section were much interested in Dr. F. A. Moss's paper on New Methods of Measuring Automobile Riding Comfort and in K. D. Smith's paper on Future Trends in Pneumatic Tires, which were presented at the technical session of the meeting held Jan. 13 in the Fort Pitt Hotel. Musical entertainment was provided at the preceding dinner and 48 attended.

Comfort-Measuring Methods

Dr. Moss pointed out the ways in which measurements had been the co-partners in every advance in engineering science. He said that engineers are familiar with measurements of size, as in pistons and cylinder walls, and in length of life and durability of parts; and that early automobiles were successful in the degree in which they had reliably fulfilled the promise to "get you there and get you back." Anything that exists can be measured, he stated, and we have found that wide variations exist in people's estimates of various things. Estimates of room temperature will vary from 10 to 14 deg. A test was then made of the member's sense of time, while Dr. Moss held a stopwatch; the estimates ranged from 9 to 40 sec., the actual time being 13 sec. The average of such estimates by a large number of people almost invariably runs too high, he remarked.

In making measurements of riding comfort, Dr. Moss continued, such measurements should be consistent regardless of where or by whom made. They should agree with previous measurements made by the same apparatus, which should give a true measurement of what one actually wishes to measure. For this reason bodily unsteadiness was chosen as an interesting index of fatigue. The development of the wabblemeter was described, from the early types in which electrical contacts recorded any tilting of the platform to later types that had an oil-pump attached to each of the four corners and so showed the amount as well as frequency of the tilt. For a comprehensive test of fatigue, measurements can be made of both muscular fatigue and reaction time of a subject; and also of fatigue of the nervous system, by making tests of the metabolism and oxygen content of the blood, Dr. Moss concluded.

Latest Tire Development Pictured

K. D. Smith, technical superintendent for the B. F. Goodrich Co., discussed the possibilities for super-balloon-tire development and stated the advantages of such tires. His paper was illustrated with lantern slides and was followed by motion pictures showing the performance of super-balloon tires on cars of standard makes under unusual conditions.

Discussion following Mr. Smith's paper brought out that super-balloon tires will require certain changes in steering alignments; in general, slightly less camber and less toe-in. While steering mechanisms are almost the same as were used on early automobiles, said one speaker, we seem to be approaching the time when all cars will have approximately the same steering alignments, considering car size and the like.

On smooth roads the "scrub," which tends to cause wear, may be greater, Mr. Smith remarked, but on rough roads the softer tires maintain better contact with the road and this reduces tire wear. The wiping action of the softer tires also tends to assure a better contact with the road, and the greater length of tire contact tends to prevent skidding. The stretch of the cords, as they become bedded down in the rubber, tends to increase tire size with use. Truck tires may increase ⅜ in. in width, thus causing contact between adjacent tires of dual-wheel equipment.

Mr. Smith called attention to the great improvement made and the lower cost per mile that has been built into tires within the last few years. This improvement has been made in spite of the fact that automobile design has definitely been in the direction of more difficult service, chiefly because of smaller rim diameters and higher speeds. One of the more recent requirements of the softer tires is that they should not be ruined when run flat for short distances. By improved methods, tire makers have made considerable improvement from this angle.

Oversizing Will Be Moderate

Another factor of increasing importance is tire noise. Noise arising from different tread designs differs considerably in amount, according to the speaker. The low-pressure tires for the immediate future will be in the 15-in. or 16-in. rim-diameter sizes, with cross-sections of either single or double oversize; rather than, for example, a 7.50 or 9.00-in. tire replacing a 5.25-in. tire, as was done this last year.

Results of many tests indicate that the difference in gasoline consumption, with the low-pressure as compared with the higher-pressure tires, is insignificant. Comparative service has been much discussed; but, as improvements in tread profiles are made to accommodate the lower pressures and eliminate some of the scuffing action, there will be no reason why the mileage obtained from the low-pressure tires should not equal or exceed that of the higher-pressure tires. The super-balloon tires are not expected to eliminate the need for car springs, as tires are not effective dampers of the larger shocks; they tend to bounce.

On roads crowned 1 ft. inner tires of dual wheels have been found to be carrying 30-per cent overload. Tire wear is greatly affected by temperature; in general, more heat reaches the tires from the brake-drums by conduction than by radiation, although much depends upon the type of wheels used. Where the tires operate in deep wells in the motorcoach body, and the running and climatic temperatures are severe, temperatures of 216 deg. fahr. are sometimes attained in the rubber.

The discussion was conducted by R. N. Austen. Prominent discussers included Mr. Schram of the McKay Co.; C. F. Kells, of the West Penn Electric Co.; A. R. Platt, specialist on wheel alignments; J. A. Harvey, of the Pittsburgh Railways Co.; H. E. Benson, of the Gulf Refining Co.; and Murray Fahnestock, of *The Ford Dealer and Service Field*.

N. A. C. A. EQUIPMENT AND ZAP FLAP INTEREST BALTIMORE

To the largest gathering of engineers ever assembled by the Baltimore Section, Starr Truscott, aeronautic engineer affiliated with the Langley Memorial aeronautic laboratory of the National Advisory Committee for Aeronautics, outlined the research work of the committee and showed slides of the laboratory equipment at the Section's aeronautic meeting on Jan. 19 in the Emerson Hotel. The second speaker of the evening, A. A. Gassner, chief engineer of the Zap Flap Development Corp. and a member of the Section, delivered a well-prepared paper explaining the construction and use of the new flap and showed motion pictures of it in action in difficult maneuvers made by Temple N. Joyce, vice-president and general manager of the B/J Aircraft Corp., in tests on certain of his own planes.

Another attraction at the meeting was the presence of Mrs. H. V. Thaden, who broke the women's world's endurance record last August by staying in the air 196 hr., and who spoke briefly at the meeting about her experience in that flight.

Ninety-five members and guests attended the dinner preceding the technical session and were entertained by John Klein and Sergei Sokolovsky with several classical musical arrangements on the cello and piano.

The technical session was attended by 181 members and guests and was presided over by Charles Froesch, Chairman of the Aeronautic Activity of the Section and service manager of the General Aviation Corp.

A great part of Mr. Truscott's talk was devoted to the use of seaplanes and flying-boats, and discussion was principally on the construction and operation of the new N.A.C.A. basin for testing hulls and floats.

Mr. Gassner exhibited a small model of the Zap flap which aroused much interest among the aircraft sress-analysis engineers. The flap is an auxiliary lifting device employed for reducing landing speed without affecting other characteristics of an airplane. The discussion on his paper was mostly on the functioning of the flap under abnormal conditions.

Those participating in discussion were Frank S. Hubbard, of the B/J Aircraft Corp.; Lessiter Milburn, of the Glenn L. Martin Co.; H. V. Thaden and Colonel Clark, of the General Aviation Mfg. Co.; and J. Henry Reisner, of the Krieder-Reisner Aircraft Corp.

Another interesting feature of the evening was the showing of a film entitled The Fourth Necessity, produced by the General Motors Corp., showing several scenes of vehicles now obsoleted and, by contrast, the present modes of transportation.

PERSONAL NOTES OF MEMBERS

Davison Elected Museum President

At the 64th annual meeting of the board of trustees of the American Museum of Natural History in New York City on Jan. 9, F. Trubee Davison was elected president of that institution to succeed Prof. Henry Fairfield Osborn, who tendered his resignation recently after 25 years' service as president. Mr. Davison was inaugurated to the office the following morning at the museum in the presence of the staff.

A Personal Note regarding Mr. Davison was published in the S. A. E. JOURNAL for November, 1932, p. 35. He was appointed to his present post as Assistant Secretary of War for Aeronautics by President Coolidge in 1926. He established the first unit of the aerial coast patrol during the Mexican Border trouble, served in the Ambulance Corps during the World War, raising funds and organizing 10 American ambulance units, and was decorated in 1920 by President Wilson with the Navy Cross. Last summer he was nominated as Republican candidate for Lieutenant Governor of New York State but went down with many of the other candidates in the November election. He was elected a trustee of the Natural History Museum in 1923 to succeed his father. In May, 1931, he was elected to Member grade in the Society and has attended and participated in a number of Aeronautic Meetings.

Seymour Now President of American Airway

Lester D. Seymour, who formerly was vice-president of the United Air Lines in Chicago, a position that he resigned recently, was elected president of American Airways, Inc., the operating subsidiary of the Aviation Corp., last December. In January Mr. Seymour announced that the executive offices of American Airways would be removed from Robertson, Mo., to Chicago, about 75 employes going there from St. Louis and Robertson. This is a step toward separation of the operating and the holding company offices. Executive officers of the operating company formerly located in New York City will make their headquarters in Chicago. Mr. Seymour was elected to Member grade in the Society in 1928 and has presented several papers at its Aeronautic Meetings.

Hughes Made General Manager of New Departure

Announcement has been made of the appointment of Frederick G. Hughes, formerly vice-president and assistant general manager of the New Departure Mfg. Co., of Bristol, Conn., as general manager of that company. Mr. Hughes has been active in Society work, having served for a number of years as Chairman of the Ball and Roller Bearings Division of the Standards Committee and as a member of that Division and the Sectional Committee on Ball-Bearing Standardization sponsored by the Society and the American Society of Mechanical Engineers and organized under the procedure of the American Standards Association.

Sloan Addresses Diplomatic Gathering

At a luncheon to diplomatic representatives of 40 countries and foreign newspaper correspondents stationed in New York City, Alfred P. Sloan, Jr., president of the General Motors Corp., discoursed on the motor-car as an instrument in the promotion of international goodwill at the Waldorf-Astoria Hotel on Jan. 11 during Automobile Show week. He said that the use of the automobile in this Country had wiped out sectional differences in speech, habits of thought and modes of living, and pointed out that cheap production of cars by builders in other countries will have a similar tendency throughout the world. This is a challenge, he said, to newspaper men to advocate better low-priced cars, better highways and the abolition of unnecessary restrictive legislation and regulations governing operation. It is also a challenge to governments to aid the movement of automobiles from country to country by road building and further extending licensing and tariff exemptions to tourists.

Chapin Sees Motor Industry Aiding Others

With the automobile business good, it will have a favorable reaction on almost all other lines of business, Roy D. Chapin, Secretary of Commerce, told the radio audience over station WINS from the Automobile Show in Grand Central Palace on Jan. 11. He said that no industry reaches out so intimately to every section of our Country or so greatly affects so many businesses as the making of motor-cars. If it and a few other major industries could call back to their jobs most of their former workers, the beginning of a real improvement in business conditions would be made. When the motor business gets into real volume again, he asserted, we can safely say that America is on the road to better times.

LePage Leaves Kellett to Design Transport Autogiros

W. Laurence LePage, formerly vice-president and chief engineer of the Kellett Autogiro Corp., has resigned his position with that organization to undertake independent work in Autogiro development, with which he has been associated since Harold Pitcairn brought the first aircraft of this type to America in 1928. Joining the Kellett organization in the capacity of engineering advisor when it was formed early in 1929, Mr. LePage has been responsible for the design and development of Kellett's successful line of side-by-side two-seater Autogiros.

With the full and active cooperation of the Autogiro Co. of America, which is making available its wide development experience and experimental facilities, Mr. LePage is devoting his whole time in his Philadelphia office to the varied problems involved in the design and construction of large transport craft.

Moskovics Elected Vice-President of A.S.A.

At the election of officers of the American Standards Association for 1933, Howard Coonley, president of the Walworth Co., was elected president of the association, and F. E. Moskovics, chairman of the board of directors of the Marmon-Herrington Co., was elected vice-president. Mr. Moskovics has represented the Society for some time in the national standardization work of the association. Mr. Coonley succeeds Bancroft Gherardi, vice-president of the American Telephone & Telegraph Co., who was the principal speaker at the Annual Dinner of the Society on Jan. 11. Mr. Coonley has been active for several years in the standardization movement as the representative of the American Society of Mechanical Engineers.

More than 570 organizations and 2700 individuals are engaged in national standardization work, which is correlated by the A.S.A. With a view to ending the confusion arising from the use of different abbreviations for technical terms, a tentative national standard for abbreviations for the more common scientific and engineering terms has been set up under the auspices of the association. The abbreviations range all the way from acres to kilovolt-amperes. This standard has just been published by the American Society of Mechanical Engineers. Four other organizations that are taking the leadership in preparing a long series of national standards for technical symbols and abbreviations for all branches of science and engineering are the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the American Society of Civil Engineers and the Association for the Promotion of Engineering Education.

Wilson Appointed Vice-President

Among recent organization changes announced by the Standard Oil Co. (Indiana) was the advancement of Robert E. Wilson to the newly created office of vice-president in charge of research and development. This comes as a recognition of the excellent services that Dr. Wilson has rendered the company in research work since he was drafted by the company as a member of its research council in 1922 from the Massachusetts Institute of Technology, of which he was director of research in the research laboratory of applied chemistry. About five years ago he was appointed assistant to the vice-president of the company, in charge of manufacturing and head of the development and patent department, and in 1931 was elected a director and appointed director of research.

Since his election to Member grade in the Society in 1921, Dr. Wilson has been active in Society affairs. He served the Mid-West (now the Chicago) Section as Chairman in 1923 and as Vice-Chairman in 1924 and represented it on the Sections Committee in 1927 and 1928. He has rendered valuable service on the Research Committee since 1924, and has been equally active on the Fuels Subcommittee, of which he was Chairman in 1927. The following year he represented the Society on the Co-operative Fuel-Research Committee and has served for a number of years on the Lubricants Subcommittee, last year as Chairman of the Oils Group of the Subcommittee.

Dr. Wilson has prepared and delivered or collaborated with other authors on many papers on fuels and oils presented at meetings of the Society and its Sections.

Ayr Elected President of Hendey Machine Co.

David Ayr, formerly connected with the Pratt & Whitney Co., of Hartford, Conn., has been elected president of the Hendey Machine Co., of Torrington, Conn., succeeding John A. Coe. Mr. Ayr brings to his new duties an experience gained in a wide variety of manufacturing of machine-tools and other products. He received his early training with the Brown & Sharpe Co., in Providence, R. I. Thereafter he was successively connected with the Pierce-Arrow Motor Car Co. in Buffalo; the Gurney Ball Bearing Co. at Jamestown, N. Y.; the Russell Motor Car Co., of Buffalo; and the Pratt & Whitney Co. He was associated with the last-named company for a number of years,

(Concluded on p. 64)

NEW MEMBERS QUALIFIED

ANDERSON, ALVIN P. (M) lubrication technologist, Shell Petroleum Corp., *Wood River, Ill.*

BAUER, PAUL (M) instructor, Purdue University, Lafayette, Ind.; (mail) 520 Russell Street, *West Lafayette, Ind.*

CUNNINGHAM, GEORGE ALLIN (J) sales engineer, Imperial Oil, Ltd., 50 Church Street, *Toronto, Ont., Can.*

CUTHILL, ROBERT W. (S M) assistant chief draftsman, Naval Aircraft Factory, League Island Navy Yard, Philadelphia; (mail) 49 Forrest Road, *Springfield, Delaware County, Pa.*

FEATHER, M. F. (M) sales engineer, Blood Bros. Machine Co., 1 Glass Street, *Allegan, Mich.*

FIKE, C. L., First Lieut. (S M) assistant engine officer, United States Marine Corp., Aircraft Squadrons, Naval Air Station, San Diego, Calif.; (mail) 906 Ninth Street, *Coronado, Calif.*

FINK, JAMES O. (M) chief designer, research division, Continental Motors Corp., *Detroit;* (mail) 384 Algonquin Boulevard.

FINN, E. PHILIP (A) president, Publix Oil Co., 175 Ipswich Street, *Boston.*

FIRESTONE, RUSSELL ALLEN (M) general manager, mechanical rubber goods division, Firestone Tire & Rubber Co., *Akron, Ohio.*

GARY, WRIGHT W. (M) director, petroleum research, M. W. Kellogg Co., 225 Broadway, *New York City.*

GRAY, ALANSON McDOWELL, JR. (J) detonation engineer, Gray Processes Corp., 961 Frelinghuysen Avenue, *Newark, N. J.*

GUILBERT, G. M. (A) sales manager, Twin Disc Clutch Co., *Racine, Wis.*

JONES, CERNYW F. (M) draftsman, Perfect Circle Co., *Hagerstown, Ind.*

KIRK, BENJAMIN K. (M) engineer, preliminary department, Baldwin Locomotive Works, Philadelphia; (mail) 912 Childs Avenue, *Drexel Hill, Pa.*

KOETZLA, DAVID J. (A) assistant engineer, Gilmore Oil Co., Ltd., 2423 East 28th Street, *Los Angeles.*

MARTIN, EDWARD A. (J) assistant automobile engineer, Vacuum Oil Co., Inc., *Paulsboro, N. J.;* (mail) 444 Lincoln Avenue.

These applicants who have qualified for admission to the Society have been welcomed into membership between Dec. 10, 1932, and Jan. 10, 1933

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (S M) Service Member; (F M) Foreign Member.

McCLOY, ARTHUR S. (A) district manager, Anaconda Wire & Cable Co., 644 New Center Building, *Detroit.*

MEAD, H. E. (M) sales engineer, Bowen Products Co., *Detroit;* (mail) 13301 Hartwell Avenue.

METASAP CHEMICAL CO., INC. (Aff.) First and Essex Streets, *Harrison, N. J.;* Representative: Cunningham, George M., technical department.

MORRIS, HERMAN C. (J) test engineer, Bureau of Standards, *City of Washington;* (mail) 527 Randolph Street, N.W.

MORRON, JOHN D. (M) manager, motor products development, development department, U. S. Rubber Co., 6600 East Jefferson Avenue, *Detroit.*

NIXON, STANLEY WORKMAN (F M) instruction engineer, Pressed Steel Co. of Great Britain, Ltd., *Cowley, Oxford, England.*

O'NEIL, WILLIAM J. (M) vice-president, in charge of manufacturing, Dodge Bros., *Detroit;* (mail) 4241 Tyler Avenue.

PITTS, T. C. (J) president, Aircraft Sheet Metal Co., *Wichita, Kan.;* (mail) 230 North Delrose.

PRITCHETT, V. CLAYTON (A) lubrication assistant to manager, Standard Oil Co. of New Jersey, 15 Washington Street, *Newark, N. J.*

ROPER, VAL J. (M) engineer, General Electric Co., Nela Park Engineering Department, *Nela Park, Cleveland.*

SHEA, GEORGE H. (J) assistant automotive engineer, Vacuum Oil Co., Inc., *Paulsboro, N. J.*

SZABADOS, CAROL (F M) chief engineer, Leonida & Co., S. A., Sos. Jianu 14-16, *Bucuresti, Roumania.*

TAWS, FRANCIS ELTON (M) manager, automotive department, H. J. Heinz Co., 1062 Progress Street, N. S., *Pittsburgh.*

THURBER, LUMAN T. (M) vice-president, Thurberator Corp., 444 Madison Avenue, *New York City.*

TOMLINSON, HERBERT R., JR. (J) aeronautic detail draftsman, Naval Aircraft Factory, League Island Navy Yard, Philadelphia; (mail) 203 Paris Avenue, *Brooklawn, N. J.*

WILSON, JOSEPH M. (A) branch manager, sales, Vacuum Oil Co., Inc., South Langhorne, Pa.; (mail) 838 Church Lane, *Yeadon, Pa.*

YOUNG, JOHN F. (A) service division manager, Ford Motor Co., *Buffalo;* (mail) 389 Parkside Avenue.

APPLICATIONS FOR MEMBERSHIP

CALLAHAN, JOHN G. P., teacher of industrial processes, Board of Education, Haaren High School, *New York City.*

CARSON, JAMES L., salesman, Autocar Sales & Service Co., *New York City.*

CORBETT, TED R., sales engineer, Emsco Asbestos Co., *New York City.*

DUNGUG, PERFECTO D., proprietor, Auto Repair Shop, *Misamis, Opon, Cebu, P. I.*

FORRER, ALFRED R., Equipment de Garage, *Paris, 18, France.*

HIERHOLZER, LIEUT. FRANK J., U. S. A., Field Artillery School, *Fort Sill, Okla.*

KAPTEYN, ALBERT, Professional Engineers Committee on Unemployment, *New York City.*

JOLY, GEORGE H., design and layout man, Buick Motor Co., *Flint Mich.*

The applications for membership received between Dec. 15, 1932, and Jan. 16, 1933, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

KETTANEH, FRANCIS ANTHONY BERNARD, managing director, Eastern Motor Co., Ltd., *Beyrouth, Syria.*

PROSSEN, LOUIS F., *Cliffside, N. J.*

ROBINSON, JAMES B., research engineer, International Harvester Co., *Fort Wayne, Ind.*

SADEE, ALBERT EDUARD MARIE, transportation engineer, General Motors Continental S.A., *Antwerp, Belgium.*

SMITH, DONALD A., *Brooklyn, N. Y.*

SPIESS, PAUL C., draftsman, Grover Loening Aircraft Co., *Garden City, N. Y.*

THOMAS, GEORGE HARRY, chief engineer, Salerni Transmission, *London, S. W. 1, England.*

WETHERBEE, BURTON W., chemical engineer, Russell Mfg. Co., *Middletown, Conn.*

NOTES AND REVIEWS

AIRCRAFT

These items give brief descriptions of technical books and articles on automotive subjects. As a rule no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.

Eighteenth Annual Report of the National Advisory Committee for Aeronautics, 1932

Published by the National Advisory Committee for Aeronautics, City of Washington; 61 pp., illustrated. Price, 15 cents. [A-1]

The Committee, in coordinating its research programs, has covered the problems in the whole field of aircraft research, both military and commercial, and has placed special emphasis on the major problems of increased safety, reliability and efficiency of aircraft. Putting the new N.A.C.A. tank in operation has made possible the undertaking of problems that will have a very important bearing on future aeronautic development. The use of these new pieces of equipment in conjunction with the other excellent facilities of the Committee's laboratories enables the Committee to carry out research programs covering the needs of both military and commercial aviation and assures continued progress.

Attention is directed particularly to Part IV of the report, presenting a summary of technical developments in aeronautics accomplished under the Committee's direction in the year 1932.

Airfoil Section Characteristics as Affected by Protuberances

By Eastman N. Jacobs. N.A.C.A. Report No. 446, 1932; 18 pp., with tables and charts. Price, 10 cents. [A-1]

The Pressure Distribution over a Long Elliptical Wing Tip on a Biplane in Flight

By Richard V. Rhode. N.A.C.A. Technical Note No. 437, December, 1932; 8 pp., 3 figs. [A-1]

Meteorological Conditions during the Formation of Ice on Aircraft

By L. T. Samuels. N.A.C.A. Technical Note No. 439, December, 1932; 20 pp., 3 tables, 5 figs. [A-1]

Flight Tests To Determine the Effect of a Fixed Auxiliary Airfoil on the Lift and Drag of a Parasol Monoplane

By Hartley A. Soulè. N.A.C.A. Technical Note No. 440, December, 1932; 9 pp., 9 figs. [A-1]

Rolling, Yawing and Hinge Moments Produced by Rectangular Ailerons

By R. H. Heald. N.A.C.A. Technical Note No. 441, January, 1933; 12 pp., 3 figs. [A-1]

Automatic Stability of Airplanes

By Fr. Haus. Translated from *L'Aéronautique*, May, June, July and August, 1932. N.A.C.A. Technical Memorandum No. 695, December, 1932; 58 pp., 32 figs. [A-1]

A Design Formula for Ailerons

By Taitiro Ogawa. Report No. 88 of the Aeronautical Research Institute, Tokyo Imperial University, November, 1932; 16 pp., with tables and charts. [A-1]

In present-day practice an airplane can be designed with confidence as to performance, strength and stability upon data supplied by theoretical analysis. But in the design of control surfaces an element of risk exists in that the designer has only his own experience and the judgment of test pilots to rely upon.

In this paper the constant initial angular acceleration is calculated for an airplane flying with minimum velocity and rolling soon after the aileron has been suddenly actuated (angular velocity 1 radian per sec.). The conclusion is that control surfaces should be designed so that the angular acceleration shall be greater than the mean value of the angular acceleration for that class in which the airplane belongs.

Mechanical Tests of Aircraft Structural Components

By I. J. Gerard. Published in *The Journal of the Royal Aeronautical Society*, September, 1932, p. 673. [A-1]

The author outlines the reasons for dependence of the strength and safety of aircraft in service on the mechanical tests of structural components. He divides such tests into two classes: *(a)* tests to establish general principles for use in design and *(b)* tests to determine the strengths of particular components under assumed service loading.

Tests of the first class are said to include research work to determine *(a)* laws relating the ultimate stresses developed in stressed parts with their geometrical proportions, *(b)* laws relating the stresses developed in materials with variations in manufacturing processes or in conditions of service, *(c)* the validity of assumptions made in the calculations of stresses in components and *(d)* the practicability of new methods of testing the strength of components.

The range of the work and its mode of application are illustrated by a series of typical examples chosen from a large number that the author has had opportunities of developing at the Royal Aircraft Establishment during 18 years of service.

Jahrbuch 1932 der Deutschen Versuchsanstalt für Luftfahrt, E. V., Berlin-Adlershof

Edited by Wilh. Hoff. Published by R. Oldenbourg, Berlin and Munich, 1932; 518 pp., 639 illustrations and 136 tables. [A-1]

The 1932 year book of the D.V.L. (German Experimental Institute for Aviation) is just off the press. The arrangement of topics is the same as in other years but, for financial reasons, the quantity of scientific material offered had to be reduced considerably as compared with former issues.

It has been decided that the Institute will remain at the Adlershof airdrome and that during the next few years its equipment and laboratories will be gradually increased and improved. The first additions are already under construction.

All departments give accounts of their activity in separate reports altogether containing more than 200 abstracts of papers, most of which have not previously been published.

The second part of the yearbook contains 53 papers of the various departments. To maintain its tradition of completeness, the D.V.L. yearbook has sacrificed appearance and included some of its articles in reprint form from periodicals.

Opinions sur L'Evolution Future des Groupes Moto-Propulseurs des Avions

By M. Waseige. Published in *Journal de la Société des Ingénieurs de L'Automobile*, October, 1932, p. 1860. [A-1]

In covering the broad subject of the future evolution of aircraft-engine-propeller groups, the author gives his opinions based on his experience as general manager of the Farman company, passing over a number of points with but brief mention and dwelling with emphasis on others thought to be of more pressing present importance.

Reduction gears are thought to be almost indispensable, and the author explains a method for determining propeller diameter and speed in relation to flight speed and air density at the altitude usually maintained. This method involves two fixed quantities: air discharge per engine horsepower and maximum peripheral speed.

Types of reduction gearing and of variable-pitch and variable-speed propeller are enumerated and the author's preferences indicated.

Various engine-design features are briefly commented upon, but supercharging—specifically, the merits of a type involving a compressor, mechanically controlled and capable of two speeds—is dealt with in considerable detail. Among accessories, the author selects cooling for particular emphasis, presenting his conclusion that, for the most efficient use of a fuel, the compression must be raised to the maximum, which necessitates cold cylinder walls.

Über einen Trägheitlosen Flugzeugkompass

By W. Ende and M. H. Gloeckner. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Oct. 28, 1932, p. 603. [A-1]

In connection with their research on cathode rays in 1929, E. Meyer and E. Brüche conceived the idea of the use of such rays, or electron rays in the earth's magnetic field, for direction indication. From this conception W. Ende developed, in cooperation with the D.V.L., the electron-ray compass, the design and performance of which are recounted in this article. Flight tests are stated to have shown the adaptability of such a compass to aircraft use. However, opposed to the advantages of flexibility and freedom from inertia are its size, weight and difficulty of installation. Lines of future development necessary are indicated.

Abflug un Schraubenschub

By Martin Schrenk. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Nov. 14, 1932. p. 629. [A-1]

Since the publication of D.V.L. Report No. 59, in 1927, the analytic calculation of take-off runs has not been further treated in German technical literature. To fill this gap, the aim in the present article is to develop a conclusive, simple and comprehensive formula for the total take-off run up to a certain height, in which all factors shall be taken into consideration. An

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NOTES AND REVIEWS

Continued

example of its application and comparison with flight-test results are asserted to show its accuracy.

Some Factors Affecting the Range of Aircraft with Special Reference to Height

By A. E. Woodward Nutt and A. F. Scroggs. Published in *The Journal of the Royal Aeronautical Society*, August, 1932, p. 604. [A-4]

After pointing out the advantages of increased range and attendant economy of flight to the commercial, military and private fields, the authors discuss the limiting factors and the improvement in range; the effect of height; the measurement of fuel consumption in flight, including consideration of the R.A.E. flowmeter and the testing of flowmeters; and the aerodynamics of range.

In Part II of the paper, fuel consumption of engines, and the factors affecting it; weak mixtures and distribution; altitude control; ignition timing; flight tests; bench tests; and, finally in Part III, the results of tests on the De Haviland Stag engine are discussed.

Catapults and Catapulting of Aeroplanes

By P. Salmon. Published in *The Journal of the Royal Aeronautical Society*, September, 1932, p. 704. [A-4]

This article outlines the history of catapulting, describes the methods in use at present and discusses the factors that must be considered.

CHASSIS PARTS

Versuche über den Wärmeaustausch zwischen Bremstrommel und Felge bei Lastkraftwagen u. Omnibussen

By H. Knoblauch. Published by Reichsverband der Automobilindustrie, Berlin, Germany; 44 pp.; 48 illustrations. [C-1]

A four-years' study of heat transfer between brake-drums and rims on motor-trucks and motorcoaches, conducted by the engineering college at Munich, is covered in this report.

Testing equipment, including thermo-electric temperature-measurement means, was developed and is described in this report. Measurements made with the equipment on the road and under controlled laboratory conditions are reported. Observations were made to determine the distribution of air currents around wheels and brake-drums during operation. Tests of models to ascertain the cause of tire failure due to rim heat were contemplated but were abandoned because of similar work already undertaken by the tire industry.

Some of the factors investigated are: the effect on heat generation of different wheel types, ribs on the brake-drum, tire-inflation pressure, air slots, air currents and different operating conditions, the difference in temperature between front and rear wheels and the maximum temperatures of brake-drums and tire treads.

ENGINES

The Effect of Connecting-Passage Diameter on the Performance of a Compression-Ignition Engine with a Precombustion Chamber

By C. S. Moore and J. H. Collins, Jr., N.A.C.A. Technical Note No. 436, November, 1932; 14 pp., 13 figs. [E-1]

The Gaseous Explosive Reaction at Constant Pressure—Further Data on the Effect of Inert Gases

By F. W. Stevens. N.A.C.A. Technical Note No. 438, December, 1932; 16 pp., 3 figs. [E-1]

Cylinder Wear in Diesel Engines

By G. D. Boerlage and B. J. J. Gravesteyn. Published in *The British Motor Ship*, August, 1932, p. 171. [E-1]

For some time the Proefstation Delft, at Delft, Holland, one of the Royal Dutch Shell group's engine-testing laboratories, has been investigating to what extent Diesel-engine cylinder wear is influenced by the fuel and the lubricating oil supplied and by the working conditions of the engine.

The authors point out that the conventional method of determining cylinder wear in Diesel engines, by measuring piston and cylinder diameters and weighing the piston-rings, involves long running periods of the engine and an appreciable loss of time for dismantling and reassembling. Apart from this direct loss of time, the method has the disadvantage that it shows the result of only one long period of running, and that result only after the termination of the run, for it is impossible to follow the wear process as it occurs during that period.

Temporarily insufficient lubrication, bad combustion or overload may result in abnormal wear, which is measured only after many weeks of running although it has been caused in a few hours by one of the disturbances mentioned. Moreover, the dismantling and refitting of vital engine parts, even if done with the utmost care, may cause abnormal

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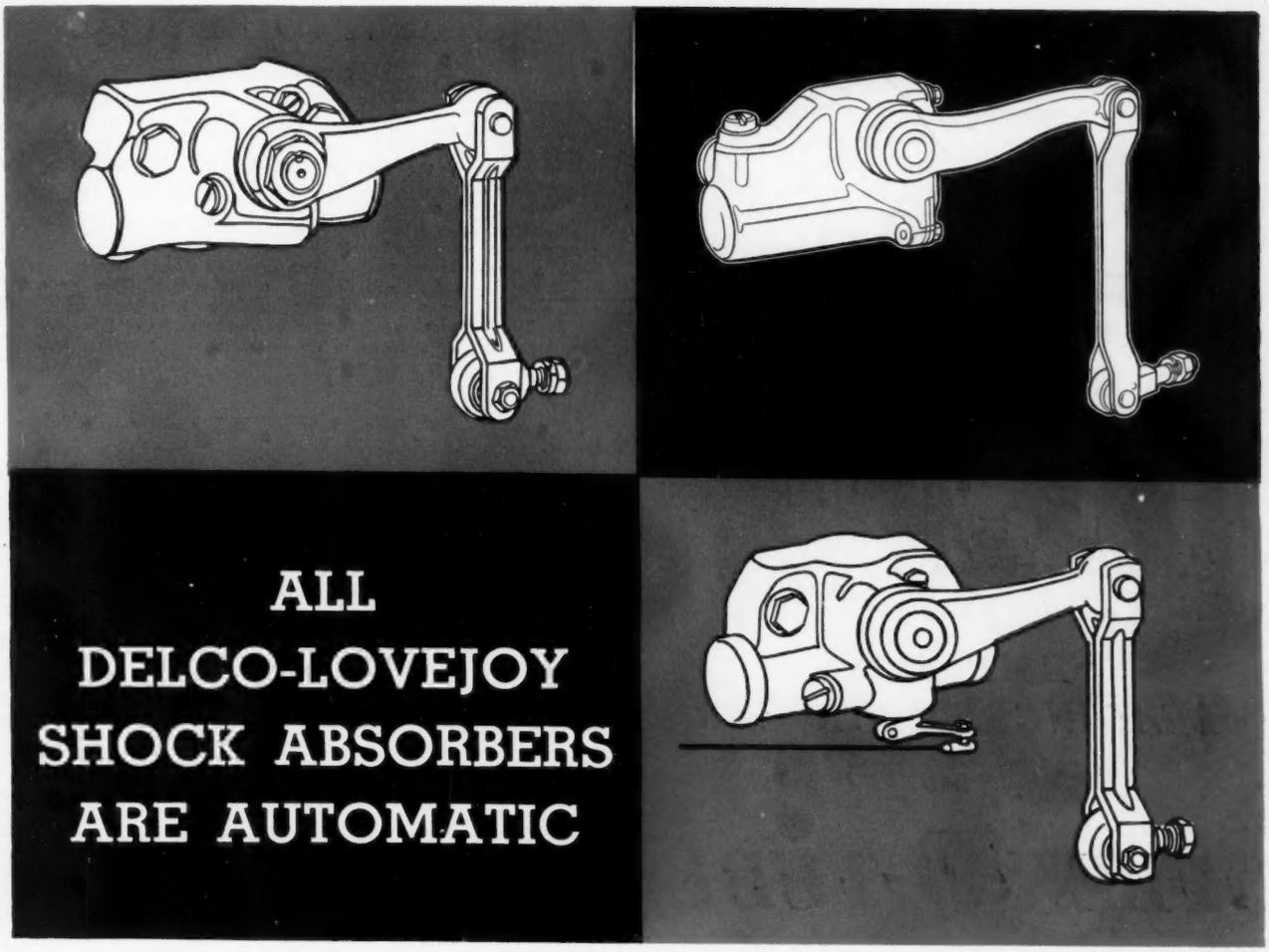

The automatic relief valve in all Delco-Lovejoy shock absorbers compensates fully for variations in temperature and load. This time-proved Delco-Lovejoy feature makes it virtually impossible to overload the mechanism, no matter how cold the oil or how sudden the thrust. It takes care of the wide variations commonly found between the temperature of the front shock absorbers and of those at the rear. It cannot get out of adjustment or fail to function. It is an exclusive principle of Delco-Lovejoy construction, a feature of all Delco-Lovejoy single-acting and duodraulic shock absorbers, which has helped to make Delco-Lovejoys the most popular shock absorbers in use today.

DELCO PRODUCTS CORPORATION, DAYTON, OHIO

★ DELCO-LOVEJOY ★

HYDRAULIC SHOCK ABSORBERS

NOTES AND REVIEWS

Continued

wear, and this again leads to wrong conclusions. Finally, much harm may already have been done to the engine.

For these reasons the finding of a method for measuring cylinder wear in a short time and in a simple way without stopping the engine became an urgent necessity.

A chemical method of analysis and of comparing the wear resulting from one fuel with that from another was developed. With the method described the rate of the cylinder wear in Diesel engines can be determined in a short time and in a simple way. The method is mainly of use for ascertaining the influence of fuel, lubricating oil and load on cylinder wear. Apparently the method could be used also for investigating the influence of varying piston-ring types and materials on the rate of wear.

Airless Injection

By S. Berg and G. Rode. Published in *The Automobile Engineer*, August, 1932, p. 366. [E-1]

The many factors that affect the nature of the injection process are very difficult, if not impossible, to evaluate by the tedious method of trial and error, the authors contend. For this reason the experimental department of the Deutsche Werke Kiel A.G. placed the whole group of problems under thorough analytical and experimental investigation.

The mechanics of pressure injection as it is evidenced by these comprehensive experiments is propounded, and the course of the injection process is treated generally and in detail. The method of investigation is unusual in that four detailed processes are recorded simultaneously. Interest attaches to the indicator specially developed for accurately measuring the pressures. It is highly sensitive, has a low inertia factor and occupies the smallest possible space.

Effect of Increasing Octane Number on Motor Fuel Performance

By W. V. Hanley. Published in *National Petroleum News*, Sept. 21, 1932, p. 27. [E-1]

The author points out that, while it is generally realized that no advantage results from raising the octane number of a gasoline above a value that will eliminate all detonation, little mention has been made of the possibility of an actual disadvantage in increasing the octane number above this value. This article presents certain data relative to the disadvantages encountered. Tests were made on Model-A Ford, Studebaker and De Soto engines.

Flame Radiation and Temperature Measurements on an Internal-Combustion Engine

By A. E. Hershey. Published in *Industrial and Engineering Chemistry*, August, 1932, p. 867. [E-1]

Three methods of flame radiation and temperature measurement discussed by the author are: (*a*) thermometric measurement with a solid in thermal equilibrium with the flame, corrections being made for the effect of the solid on the flame; (*b*) radiometric measurement from the flame radiation, corrections being made for the imperfections of the radiator, and (*c*) thermal and chemical measurement (calculated temperatures) from the ΔH for the combustion reaction and the specific heat of the products of combustion, correction being made for dissociation and losses.

The last two methods are compared as applied to a determination of flame temperature in an internal-combustion engine.

Les Vibrations de Torsion dans les Moteurs d'Aviation Actuels

By Alexandre Gorfinkel. Published in *Le Génie Civil*, Oct. 8, p. 355, and Oct. 15, 1932, p. 377. [E-1]

A semi-empirical formula for the direct calculation of the critical speeds of in-line, V, W and radial aircraft engines is developed. In applying this formula the author demonstrates the advantages of placing the auxiliary drive and the supercharger near the propeller instead of at the opposite end of the crankshaft. A study is made of the amplitude of vibrations experienced and the effect on it of firing order and of the angles between cylinder rows in V and W-type engines.

Zwischen Benz und Diesel

By Wa. Ostwald. Published in *Automobiltechnische Zeitschrift*, Oct. 10, 1932, p. 457. [E-1]

Introducing an issue of this journal devoted to automotive Diesel engines, this article is an attempt to show that the carbureter-engine and the Diesel engine are, in the course of their development, tending to approach each other ever more closely in form and operation and to point out the fields for further research that this situation reveals.

Other articles in the issue include specifications of the more recent automotive Diesel engines, discussions of detonation and scavenging in Diesels and descriptions of the following engines: Michel, Humboldt-Deutz, Büssing-N.A.G., M.A.N., Oberhänsli, Daimler-Benz and Krupp-Junkers.

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More than MECHANICAL PERFECTION

THE present day motor car buyer looks for more than mechanical excellence. Buyers are looking farther ahead. They are interested in how their car is going to perform and how it is going to look in three, four or five years from now. They especially want to know how it is going to look.

They already know, through several years of observation, that Parker Processed cars retain their original fine appearance, they do not rust, they are easier to keep in good condition, they do not require frequent refinishing.

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NOTES AND REVIEWS

Continued

MATERIAL

Symposium on Steel Castings

Published jointly by the American Society for Testing Materials, Philadelphia; and the American Foundrymen's Association, Chicago; 1932; 254 pp., illustrated. [G-1]

Ten extensive technical papers comprise the Symposium on Steel Castings presented at the joint meeting of the A.S.T.M. and the American Foundrymen's Association held in Atlantic City, N. J., last June.

The first two papers give, respectively, a general survey of the industry and statistical data on steel-castings production in the United States. Then follows a contribution on the design of steel castings, which emphasizes the importance of cooperation between designer and founder and discusses extensively the phenomena of contraction and crystallization.

A paper entitled Purchase Requirements for Steel Castings, with Notes on Physical Properties in Test Bars and in Commercial Castings explains design factors that influence test-specimen results and chemical limitations for carbon steel and summarizes the A.S.T.M. and other specifications for carbon-steel and alloy-steel castings. One of the most extensive papers gives physical and mechanical properties of some well-known cast steels, presenting a comprehensive correlation of data from many sources, both domestic and foreign. Representative properties of cast medium-pearlitic steels are thoroughly reviewed.

A technical paper on Castings of Corrosion-Resistant Steels gives extensive data on the principal classes of these alloys.

Other papers cover austenitic manganese-steel castings, problems and practices in the heat-treating of steel castings, and fusion welding as related to steel castings.

Extensive oral and written discussion adds to the value of the papers, presenting a broader view of the subjects.

The Proceedings of the American Society for Testing Materials, Vol. 32, 1932

This volume, issued in two parts, is now available. Part I (1071 pp.) contains the annual reports of committees and tentative standards. Part II (824 pp.) contains technical papers, with discussion. [G-1]

The Knock Rating of Naphthene and Aromatic Hydrocarbons

By F. H. Garner and E. B. Evans. Published in the *Journal of the Institution of Petroleum Technologists,* September, 1932, p. 751. [G-1]

The following conclusions are reached by the authors of this article:

(1) In the cyclohexane and cyclopentane series the octane number decreases as the number of carbon atoms in the molecule is increased.

(2) In the aromatic hydrocarbon series the octane number increases until the member of the series containing nine carbon atoms is reached, and in general the octane number of aromatic hydrocarbons is less affected by substitution, insofar as knock rating is concerned, than hydrocarbons of other series.

(3) Lovell, Campbell and Boyd's rule that the more centralized the molecule is, the higher is the octane number, holds in the case of the cyclopentane, cyclohexane and aromatic hydrocarbons investigated in the present paper.

(4) The octane number shows lower figures at 300 deg. fahr. than at 212 deg. fahr. with the lower members of the series, but in the higher members of the series the octane number is greater at 300 than at 212 deg. fahr.

(5) It is shown that, insofar as the increase in octane number is concerned, when lead is added to the members of the various hydrocarbon series, the increasing order of susceptibility is: aromatics, cyclohexanes, cyclopentanes and, most responsive of all, α-olefines.

MISCELLANEOUS

Hoyer-Kreuter Technologisches Wörterbuch

Edited by Dr. Ing. Alfred Schlomann. Published by Julius Springer, Berlin, Germany; 2295 pp. [H-1]

The field of foreign-language technical dictionaries is ably reinforced by this new sixth edition of the Hoyer-Kreuter Technical Dictionary. This is a three-volume German-English-French publication, each of the volumes containing the primary alphabetical listings in one of the three languages.

Whereas the five previous editions were specialized dictionaries limited to distinct fields, this latest form is universal in scope. It contains about 100,000 terms, approximately 44,000 of them being new additions to cover recent developments. Emphasis is laid on the inclusion of a large number of colloquial terms and on the supplementing of the main key-words by expressions having the same meaning.

Dr. Alfred Schlomann, the editor, is well known for his illustrated

(Continued on next left-hand page)

NOTES AND REVIEWS

Concluded

technical dictionaries. He was requested to make this latest revision of the Hoyer-Kreuter work by the Assembly of German Scientific and Engineering Societies.

Das Gleitlager im Kraftfahrzeugbau

By E. Falz. Published in *Automobiltechnische Zeitschrift,* Sept. 25, p. 431; and Oct. 25, 1932, p. 489. [H-1]

In the modern technique of journal-bearing design, certain elements are regarded as important in securing satisfactory friction-free performance. They are the installation of the bearing, its length, heat transfer, surface finish, bearing play and lubrication. Following this theoretical analysis, the author gives practical examples of the design of crankshaft, transmission, differential and rear and front-axle bearings. Finally, fundamental rules are given for designing a fully lubricated journal bearing, with special application to crankshaft bearings.

Le XXVIe Salon de l'Automobile

By G. Delanghe. Published in *Le Génie Civil,* Oct. 22, p. 393; Oct. 29, p. 429; and Nov. 5, 1932, p. 453. [H-1]

A most brilliant success, is the author's characterization of the 26th automobile salon in Paris, at which 38 French manufacturers, presenting a total of 118 vehicles, and 34 foreign firms exhibited.

Satisfactory progress, in spite of the economic crisis, is stated to have been shown in the industry. The number of vehicles in circulation in France has increased by 200,000 during the year, the present total being 1,800,000, or 1 for each 24 persons. About 201,000 vehicles were manufactured in France in 1931, or about 10 per cent less than in the preceding year. The export trade fared twice as badly in percentage decrease, only 30,120 French cars having been sold to other countries. Almost all of the 13,724 imported automobiles came from the United States. About 500,000 persons are engaged in the automotive or allied industries.

Other topics treated in the general industrial section of the article are motorization of the army, development of highway transportation, traffic regulation and the pneumatic-tired rail-car.

Design features selected for particular emphasis in the general technical review are the increasing quietness of engine operation, carbureters, ignition and electric equipment, auxiliaries actuated by manifold vacuum, thermostatically regulated hydraulic shock-absorbers, super-balloon tires and body developments.

Detailed descriptions of the exhibits are given.

MOTOR TRUCK

Railroads Use Hundreds of Autos To Cut Costs

Published in *Railway Age,* Aug. 6, 1932, p. 175. [K-4]

After more than a year of investigation, the *Railway Age* has completed a survey of automotive equipment in railroad work. This survey does not pretend to cover all of this equipment that is thus utilized. The present survey was conducted, rather, to ascertain the number of company-owned automobiles, motor-trucks, industrial tractors and other trackless equipment used at railroad storehouses, shops, passenger and freight stations, docks and piers, and other places, for handling material and performing other non-revenue work.

PASSENGER CAR

La Production 1933

By C. Faroux. Published in *La Vie Automobile,* Sept. 25, 1932, p. 345. [L-1]

A trend toward a new basic conception of the nature of automotive-vehicle construction is stated to be one of the most outstanding impressions drawn from the 1932 Paris Salon. In the past, the body has been regarded as a box or case, attached to a self-contained chassis by assembling bolts. However, the importance of the body as a unit, especially from the points of view of roadability, shimmy, suspension and vibration, has been proved, and the day is beginning to dawn when the automotive vehicle will be essentially a body, to which will be added a mechanical assemblage capable of assuring its propulsion.

More specific developments singled out as characteristic of the show models are the popularity of the small car, crankshaft balance, the super-balloon tire and the perfection of detail rather than the introduction of innovations.

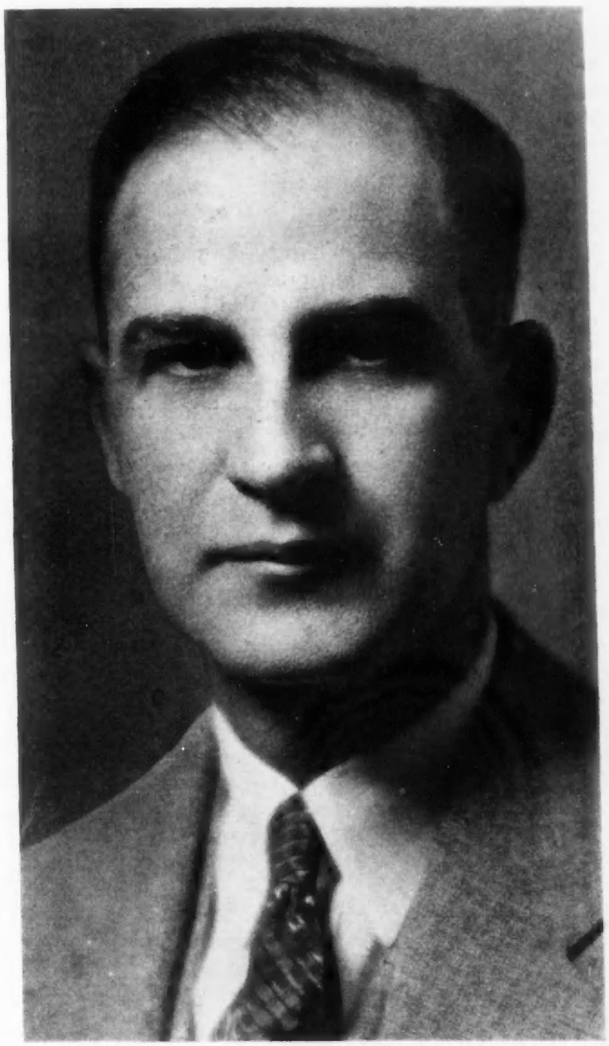
Prevention of Automobile Accidents

By Victor W. Pagé. Published by the Norman W. Henley Publishing Co., New York City, 1932; 172 pp. [L-4]

This book is a practical guide to expert driving and contains numerous suggestions for safe and sane operation of automobiles on the highway. It includes instructions for inspection and adjustment of car mechanism to prevent loss of control.

Engineer's Big Chance Is Here—Will He Take It?

By James M. Crawford
Chief Engineer, Chevrolet Motor Co.



James M. Crawford

LATELY I have heard loud rumblings of the engineer's return to a dominant place in the automotive picture.

First, he was called upon for new products with which to break the depression. Buying had to be stimulated by product appeal. Education of the public along engineering lines was taking form.

But, apparently, the engineers did not come through. At least nothing "revolutionary" was produced that "clicked."

Then, the trade papers started. A series of articles appeared in one of the newer magazines, telling what was wrong with the engineer. The sales manager, production man, purchasing agent and the parts supplier, all took their turn in the educational process. In the same medium the engineer was given a chance to talk back—and he did, with vengeance.

It all indicated to me that the industry needed help; that this flood-tide of criticism had been held back until just recently by the idea that industry could get along without the engineer playing too prominent a part in its progress.

But history has a way of repeating itself—this time because the advertising man ran out of material! Sales figures had lost their appeal; there were none. Manufacturing facilities and precision could be presented only in dry statistics. The product was a logical subject, but it had to be glorified. So again the engineer was called to the head of the class.

Engineers today feel a great deal like the Democratic Party the day following the election. After waiting all these long years for our big chance, what are we going to do with it?

HERE is part of what the January Detroit Section *Supercharger* had to say about this author:

"Jim left the corn belt for the big city of Detroit in 1927 to take over a big job—Chevrolet. In his career he has tackled some tough ones. The old American-underslung; who remembers that? Then Chalmers—they both were big shots once. Then the Allen—five years there; then Auburn.

"He has a warm spot in his heart for the fellows that build, sell and use motor cars and he believes in working with them to the limit—

"But let him tell it . . . "

Will we make the most of our opportunities by considering the future development of transportation as an organization problem, or will we treat it as a strictly engineering job, and merit the criticism that so often has been directed at engineers in general?

Obviously, we will increase our opportunities if we go the cooperative route—and cooperation begins with the Big Boss. We must not fall down on that gentleman! We must keep our eyes open for new ideas and establish a forward-looking program. We must take all of the factors in our business into consideration when we make a recommendation—but, be sure that the engineering contribution to your picture is backed up by fact.

Don't Pass the Buck

The engineer sometimes defends himself against criticism when a defect is apparent in a product by passing the "buck" to the management as having overruled him. When he does this, it seems to me, he loses the greatest of all his opportunities, the opportunity to gain the confidence of his management on the basis of strictly *engineering* ability.

This same principle applies to all engineers from the chief down.

Naturally, if we are going to cooperate effectively with other parts of the business we must set up our engineering organization with that thought in our minds. We can't just set up a designing organization and act courteously to the other departments. Active cooperation is essential.

As far as manufacturing is concerned, designation of certain engineers to act as contact men with the manufacturing organization and setting up committees to pass on design from a manufacturing standpoint, is simply a gesture at cooperation. Engineers are properly put *in* the unit manufacturing plants and, to a certain degree, are responsible to the manufacturing manager. They know the requirements of the development engineer and are in a position to assist him in arriving at a satisfactory design from the manufacturing as well as the engineering standpoint. This is important in volume production, where new equipment is required for improving the product.

In all projects, the engineer's work should go hand in hand with development. When samples are made from production dies and tools, it is possible to avoid that bugaboo of all engineers as to whether production will be up to engineering samples.

This practice, in no way, restricts progress; rather it checkmates disaster by bringing to the surface all problems of cost and volume early enough to permit their being met without sacrifice of quality or date of introduction.

Such close contact between manufacturing and engineering keeps production equipment in step with engineering progress. It puts both the factory manager and the engineer in a position to adjust themselves to rapidly-changing demand, wherever it may come from.

In Chevrolet we even go further. The production man pokes his nose in our laboratory; his representatives are at the proving ground. He sees our weakness as well as our strength. And he, in return, has nothing to cover up when we join hands in cleaning up a job.

This cooperative arrangement is the engineer's second big opportunity. He has had his chance to get the most out of men, machines and material. He has given other engineers an opportunity to develop themselves by broadening their experience under remote control. Failing in either, he can only pass along to the production department the responsibility of making units to engineering specification. Other responsibilities of various kinds are controlled by management itself.

I need not emphasize the importance of working with the sales and service departments. They are the branches of our business in touch with the consumer. We should pay a lot of attention to them when laying out our product program.

Upon management, of course, rests primary responsibility for attention to this consumer-contact phase of the business, but this in no way restricts the engineer in his opportunity to find out what the consumer wants in a transportation unit.

Simply because the engineer is charged with the design of a product is no reason why he should dictate *all* of its characteristics.

Requests are bound to come from the sales department as a result of its endeavor to keep the product in the best possible competitive position.

These requests should be recognized, and immediate action should be taken, *if justified*. No sales manager, however, is going to think well of an engineer who accepts sales department suggestions and then "passes the buck" to the sales manager when the result is unsatisfactory in the field.

Too many attempts have been made to design a car around a sales slogan or a list of features. Too often manufacturing facilities have determined the essence of a design. Performance has been rated too high a factor in some. It is the engineer's job to evaluate all of these factors which flow to him through the regular channels in his organization, and plan for the long pull.

The revolutionist is with us, demanding a change. We cannot ignore him. He usually is a lovable fellow and a real inspiration at times. But how he can get under our skin sometimes.

Many of them fully realize that the very structure of our economic system demands progress by evolution, but they are looking ahead. They are not bound by tradition.

Last year at the production dinner you heard the automotive industry flayed by Maurice Holland. He criticised our research in no uncertain terms when he branded it as a "talkie with sound effect, but very little action." It is unfortunate that he could not get behind the scenes in some of the really great laboratories where activity is not limited by a group of division engineers.

New Thrills in Future

It is a far cry from the days when the engineer guided the destinies of the automobile business to today when organized effort is the controlling influence.

Some bemoan the passing of the pioneer days, feeling that the romantic period of a dynamic industry is over. But, I will not believe it is over for the research worker who is developing new processes and materials, nor for those engineers with new ideas, stimulated by the desire for self-expression or volume production.

In the future, test engineers in the laboratory and at the proving ground will get the same thrill out of their contribution to the development of transportation, as did the racing driver in the days gone by. When the beam goes up on the dynamometer and stays there hour after hour; when the throttle is opened wide on the speed loop and held there until the tank runs dry, thus will the engineers of the future write in their records the progress of an organization!

Chronicle *and* Comment

By
Norman G. Shidle

SHORTLY after our arrival here on Feb. 1, John Warner insisted that this page should become our special charge each month and no amount of protesting on our part could change his mind.

So it looks as though JOURNAL readers were in for it. Fortunately, however, we are going to have Mr. Warner's cooperation in the preparation of the page through his own contributions from time to time and through his continuous advice and help.

But we'll need plenty of other assistance. We'd like to be in correspondence with every member of the Society more or less regularly—not only because we will need new ideas with which to fill this new responsibility, but also because the JOURNAL needs such contacts if it is to continue to meet the greatest needs of the greatest numbers in the Society.

OUR FIRST item of comment must be an expression of sincere appreciation to all those Society members who recently have written specific ideas and suggestions about the JOURNAL and its possible improvement.

Never in all of our editorial experience have we found so much practical value in a set of editorial suggestions from a non-editorial group. Particularly was there evident a keen, though subconscious, appreciation of the specific problems brought by the times, the budgets and the limitations of human beings.

At first, we were a bit surprised that this should be so. Yet, as we sat back and thought about that pile of stimulating letters, we realized suddenly that there was no good reason for surprise; that just this same fine sense of balance has been common in the attitude of the average Society member toward the task of developing his Society in general. Which is, of course, the chief reason that the S.A.E. has become an even more potent factor in automotive affairs since the beginning of the depression than ever before.

SOME of the suggestions, naturally, are diametrically opposed to others. That is to be expected. But generally speaking, the ideas are such as to cause any sensible editor to stop, look and listen.

Practically everybody likes the new cover.

A desire for more articles of general human interest along automotive engineering lines was expressed more frequently than any other single suggestion. Time and again, the Wolf, Horning and Crane articles which appeared in the January issue were mentioned favorably as examples.

Typical of the thinking along this line was the crisp comment of Carl Breer, Chrysler's executive engineer, who wrote: "While members of the S.A.E. are specially trained in a particular branch of science, we find them all ordinary human beings and, on the average, the psychological factors which arouse their attention are those which are common to all other human beings as well."

PRESIDENT DICKINSON'S stirring economic theory, presented first to the Society at its annual meeting in a paper titled "The Mechanics of Recovery," is receiving considerable attention from men outside as well as inside the Society. To meet the demand for further information regarding Dr. Dickinson's views, new reprints of his annual meeting paper are being prepared which will include a series of graphic and pictorial charts, which together with their captions, dramatize the whole conception in relatively brief form.

A number of Sections have asked Dr. Dickinson to talk to them personally regarding "The Mechanics of Recovery." Many of these requests he will fulfill during his visits among the Sections.

IF THERE is anything in a little proverb, coined recently by B. C. Forbes, 1933 ought to be a great year for a vast majority of automotive engineers and for the automotive industry in general. Forbes said:

"Success is easiest when others quit".

Throughout its history the automotive engineering profession has been characterized by the scarcity of quitters in its ranks. And if anything were needed to prove that contention, the last three years certainly have done so.

Standard Truck

Agreement comes after productive debate over year-and-a-half period

FATIGUED with a mellow lassitude engendered by a fine day's golf, or tired with the weariness of long miles of automobile driving, a hundred and fifty automotive engineers are gathered in the cheerfully lighted auditorium of the Greenbrier Hotel at White Sulphur Springs listening to L. R. Buckendale, Timken's executive engineer, suggest a specific and detailed formula for rating of motor trucks.

It is the opening session of the 1931 Summer Meeting of the Society of Automotive Engineers. Already has been heard a vigorous plea for some standard method of rating motor truck capacity made by Martin Pulcher, Federal Truck president, long a proponent of such action.

The session goes on. Gradually dull eyes begin to brighten. An atmosphere of attentiveness begins to pervade the gathering. The dark-haired Timken technician talks on, driving home one after another vital, specific suggestions to be used as a basis for a standard truck rating formula. He nears the end . . . "And in closing I propose that trucks be rated by a gross vehicle weight that can be hauled up standard grades . . . "

He sits down. Applause. A moment's silence. Then the argument starts. Several speakers clamor for the floor at once.

Sagacious Henry Alden, only two-time President of the Society, is in the chair, accompanied by his inevitable curved-stem pipe. He recognizes the man first on his feet.

"It is doubtful if the Society or any other organization would be capable of mastering such a task. . . . " This speaker is followed by others. Says one:—"So long as research and engineering persists in developing better ways of doing things, just so long will formulae of this type be misleading and ineffective. . . . "

Then arises a series of speakers definitely favoring the attempt to get a standard rating . . . A list of their names reads like a page from the 400 of automotive engineering: J. F. Winchester, of S. O. of N. J.; T. C. Smith, of A. T. & T.; B. B. Bachman, of Autocar; A. J. Scaife, of White; C. A. Pierce, of Diamond T; W. S. James, of Studebaker; A. G. Herreshoff, of Dodge; J. M. Orr, of Pittsburgh; D. P. Pierce, of Vacuum; M. C. Horine, of Mack; F. C. Horner and Pierre Schon, of General Motors; and others.

Finally there is a pause in the polemics. A brief moment of calm. Then:

"Mr. Chairman!"

Forceful speaking, square-shouldered F. K. Glynn, maintenance chief of the country's largest motor vehicle fleet, is on his feet. Eyes are turned toward him expectantly. "Mr. Chairman," he says, "I wish to propose for adoption the following resolution:

"It is the recommendation of this meeting that the Motor-coach and Motortruck Activity Committee, together with the Transportation and Maintenance Activity Committee, form a joint committee to study truck rating with a view to bringing forth some generally acceptable method of rating trucks."

Brief, crisp debate follows. Unfavorable comments are made. But the motion is carried.

The resolution was approved by the Council on the following day. The Society of Automotive Engineers had committed itself to attempt a job that had been considered impossible for years—a job which many said couldn't and some said shouldn't be done. Broad courage as well as vision directed the decision.

Reporting the meeting one skeptical trade paper editor wrote: "It will be many, many months, perhaps years after

Rating *OK for* Trial

A Method of Rating Commercial Vehicles

Approved by S. A. E. Motorcoach and Motortruck Rating Committee and by the Council of the Society for circulation by publication so that it can be given a sufficient time for trial before it is referred to the S. A. E. Standards Committee for formal adoption.

The manufacturer will express the vehicle rating by the following four terms arranged as a hyphenated four-term number.

1—Gross Capacity of Chassis to nearest hundred pounds, to include the maximum allowable sum of the weights of the payload, body, cab, body equipment and mechanical appliances. This term is for the purpose of classification.

2—Gross Vehicle Weight to nearest hundred pounds, to constitute the sum of the Gross Capacity and the total chassis weight and to represent the maximum allowable gross weight permissible on pneumatic tires of maximum capacity authorized by the manufacturer for the particular model, without loading any one of the tires beyond its capacity as rated by the Tire & Rim Association. This is the manufacturer's gross vehicle weight rating.

3—Net Chassis Weight to nearest hundred pounds, to constitute the difference between the weight of the standard chassis minus the combined weights of engines, engine accessories, radiator, clutch and transmission. This is to be given as pertinent information.

4—Performance Factor, a numerical index of performance to be determined by the formula

$$\text{Performance Factor} = \frac{3.34 \times \text{Piston Disp.} \times \text{Gov. Speed}}{\text{Gross Vehicle Weight}}$$

and convertible into terms of relative grade and speed ability by the use of supplementary formulas.

A typical rating, for example, would be 100-231-51-229 for a motor truck nominally rated at 5 tons capacity, having a gross weight of 23,125 lbs., a net chassis weight (without power plant) of 5075 lbs., engine displacement of 530 cu. in. and a governed speed of 3000 R.P.M.

In addition to the above rating the manufacturer will give the following supplementary information.

1—Displacement of engine, expressed in cubic inches.
2—Rear axle ratio.
3—Transmission ratios.
4—Tire size (max.).
5—R.P.M. of engine at governed or recommended maximum speed.
6—CA dimension. (Distance from back of cab to center of axle).
7—Wheel base in inches.

(See next page for Explanatory Data and Formulas)

the committee actually begins to function before anything like generally agreed upon results can be expected." But he did have the grace to add: "In the meantime there is real inspiration to be gathered from the knowledge that this vital problem finally is going to be tackled specifically, scientifically and cooperatively and that the full facilities and the eminent personnel of this great automotive engineering organization will be at the disposal of the representative group finally charged with the seeking of a satisfactory formula."

The committee was chosen with care. It was made fully representative of all interests, commercially and technically. Its personnel was not finally approved by the Council until late in August, 1931. L. R. Buckendale, author of the suggested formula which was to form the first battle-ground of the committee, was made chairman. Other members were W. D. Reese, M. C. Horine, A. W. Scarratt, C. A. Pierce, A. H. Gossard, Adrian Hughes, Jr., A. G. Herreshoff, A. K. Brumbaugh, B. B. Bachman, A. S. McArthur, J. F. Winchester, H. W. Drake and F. K. Glynn.

The first meeting of the committee was held in Committee Room 8 of the Atlantic City Auditorium, in Atlantic City, N. J., on Sept. 29, during the convention of the American Electric Railway Association. All possible methods of attack on the problems were considered at this first session. Some method of rating by means of an ability factor seemed to offer the best hope of progress.

Then followed the Washington session, during a National Transportation Meeting, on Oct. 27, 1931. Debate went on. Toward the end of that session final decision seemed to loom ahead. But it was only a short time before disagreement arose again, so vigorous this time as to cast doubt on the possibility of any final accord ever being reached.

So it went through numerous other committee meetings, through long letters and lengthy informal discussions among committee members and others. Several times a finally okayed report seemed imminent. But each time some new idea or some recurrence of an old argument prevented unanimous action.

White Sulphur Springs, Washington, Toronto, Chicago, Detroit . . . over much of the United States and in parts of Canada the members of the committee worked, sweated, fought, cooperated and finally, in Detroit, achieved definite results.

Out of the Rating committee meeting held in Detroit on Jan. 24, 1933, came the word: "A truck rating formula has finally been agreed upon by an overwhelming majority of the entire committee, which recommends that this formula be offered to truck manufacturers for trial."

That recommendation went before the Council at its February meeting in New York and was approved.

As this issue of the JOURNAL reaches its readers, the scientifically worked out formula for rating motor trucks which appears herewith is officially offered to truck manufacturers for trial by the Motor Truck and Motor Coach Rating Committee of the Society of Automotive Engineers. If after a period of trial, the formula is seen to be practical and effective, the committee will recommend its incorporation into the standards of the Society.

Once again, it seems as though a Society group has achieved the impossible.

Certainly, this agreement on a truck rating formula must be hailed by the industry as a whole as one of the most constructive, practical engineering jobs which the Society has ever done. To the members of the committee which produced this formula, the industry as well as the Society owes a debt of gratitude.

That debt is a very real one whether later changes are found necessary or not. Manufacturers and operators in some instances have already been applying the new rating in practice informally for several months. One very large operator, at least, already has compiled a good-sized set of experience records.

Explanatory Data and Formulas

The symbols and their definitions as used in the following formulas are

GVW = Gross Vehicle Weight to nearest hundred pounds. This weight includes chassis, body and payload and is measured at the tires on the ground.

GTW = Gross Train Weight in pounds. This weight includes chassis, body and payload of truck or tractor and trailers, measured at the tires on the ground.

D = Cubic Inch Displacement of Engine.

T = Engine Torque, maximum, in pounds-feet, available for vehicle propulsion. A recommended basis for purposes of comparison is 0.625 pounds-feet torque per cubic inch displacement. This is an average value for average conditions and may vary slightly from actual torque developed. In the Performance Factor formula, due to the fact that the torque used is the torque at the maximum rated speed, an additional factor of 0.83 must be used so that the factor becomes 0.625×0.83 or 0.519.

R = Axle Gear Reduction.

r = Rolling Radius of loaded driving tires in inches.

RF = Road Rolling Resistance Factor in pounds per pound of GVW or GTW. A recommended basis for purposes of comparison is 0.015, and average value.

G = Grade in per cent.

e = Efficiency from engine to tires in direct drive. A recommended average is 0.90 in direct gear and 0.80 in indirect drive.

BHP = Brake Horsepower available for propulsion of vehicle or train.

MPH = Vehicle Speed in miles per hour at rated maximum engine speed.

RPM = Engine Speed in revolutions per minute in direct gear at recommended governed or equivalent speed only.

PF = Performance Factor.

Formulae are shown below for determining the various characteristics of the vehicle including the formulae for the Performance Factor (PF), together with formulae for interpreting the performance formulae into relative grade and speed ability.

(1) $$\text{GVW or GTW} = \frac{T \times 12 \times e \times R}{r\left(\frac{G}{100} + R\,F\right)} = \frac{6.75\,D\,R}{r\left(\frac{G}{100} + 0.015\right)}$$

(2) $$G = \frac{100\,T \times 12 \times e \times R}{r \times GVW} - 100\,R\,F = \frac{675\,D\,R}{r \times GVW} - 1.5$$

(3) $$T = \frac{GVW \times r\left(\frac{G}{100} + R\,F\right)}{12 \times e \times R} = \frac{GVW \times r\left(\frac{G}{100} + R\,F\right)}{10.8\,R}$$

(4) $$MPH = \frac{RPM\ 60\ 2\,\pi\,r}{5280 \times 12 \times R} = \frac{RPM \times r}{168\,R}$$

(5) $$RPM = \frac{MPH \times R \times 168}{r}$$

(6) $$\text{Performance Factor (PF)} = \frac{3.34 \times \text{Piston Disp.} \times \text{Gov. Speed}}{\text{Gross Vehicle Weight}}$$

(7) $$\text{Miles per Hour at Gov. Speed} = \frac{\text{Performance Factor}}{\text{Grade in per cent} + 1.5}$$

(8) $$\text{Grade in per cent} = \frac{\text{Performance Factor}}{\text{MPH at Gov. Speed} - 1.6}$$

Get-Your-Man Campaign Nears End

WITH the exception of one or two qualifications, and a controversial point which is now before the Committee of Awards and the Council for decision, the Get-Your-Man Campaign has virtually reached a conclusion. Final announcement of a complete slate of winners is therefore retarded, and must, of necessity, be held over until the April issue of the JOURNAL. There have been a few changes in the relative positions of the contenders, but Philadelphia is still topping the list for Section awards, with Indiana not so far behind. The Canadian Section has made an appreciable advance, and Indiana had better look to its laurels.

R. N. DuBois and L. M. Porter are following on the heels of John Hardecker, who has enjoyed first place for some time past. However, all will be known next month.

The standing of the Sections and individuals are given in the following tables:

SECTION STANDING

(Expressed in Percentage of Quota)

Philadelphia	50.8
Indiana	39.2
Canadian	38.0
Baltimore	32.8
Northwest	31.2
Southern California	29.0
Detroit	22.5
Metropolitan	21.2
Chicago	19.5
Pittsburgh	18.6
Kansas City	16.6
Washington	15.0
Cleveland	12.3
Syracuse	12.1
Wichita	11.8
Buffalo	10.5
St. Louis	9.7
Northern California	9.0
Dayton	8.1
New England	7.8
Milwaukee	7.1
Oregon	0.0

INDIVIDUAL STANDING

(For Individual Awards)

First Place

John F. Hardecker

Tied for Second Place

R. N. DuBois
L. M. Porter

Tied for Third Place

H. M. Jacklin
C. C. Mathis

Tied for Fourth Place

A. Gelpke
F. K. Glynn
C. H. Jacobsen
L. R. Joslin
B. J. Lemon
Reese Lloyd
L. V. Newton

Tied for Fifth Place

George B. Allen
John G. Holmstrom
R. N. Janeway
P. J. Kent
G. O. Pooley
C. C. Stewart
R. R. Teetor
O. M. Thornton

There is much to be said for the spirit in which the individual members of the Society and the Sections have entered in the Get-Your-Man Campaign. The friendly rivalry extant among some of the Sections and individuals in competition for the various awards has enlivened the period of the campaign considerably. This fraternal spirit has been obvious since the outset of the campaign and is in large part responsible for the excellent results obtained.

Standards Groups Go into Action with Energetic 1933 Plans

SCORES of new standardization projects, practical and vital to progress in every phase of motor vehicle design and operation, are being undertaken by various divisions of the Standards Committee as the Society's new administrative year gets under way.

New objectives have been outlined, also, for development of other standards activities which already have been in process for many months, while final action on a number of important items is scheduled for 1933.

Only projects of major importance can be included in a brief summary of the Standards Committee work contemplated in the immediate future, since an adequate description of even this group of projects would require individual analyses of some length. The following terse summary of some of the more important plans, however, indicates clearly the broad scope and practical usefulness of the 1933 Standards Committee program.

Parts Standardization

Most of the 19 Divisions of the Standards Committee are concerned more or less with parts standardization. In the Aircraft Division a study has been started of the relation between the tolerances of the bolt diameter and the hole diameter. Dimensional standardization for aircraft bushings, cables, electrical equipment, brakes, tires, rims and wheels is also scheduled, largely in conjunction with the Army-Navy Standards Conferences. The aircraft engine projects include spark plugs, fuel pump mountings and the standardization of both splined and taper types of propeller hubs and shaft-ends, the latter being contemplated revisions of present standards.

The work of other Divisions includes such dimensional projects as square keys, a narrow, light series of ball bearings and enclosed thrust ball bearings; flanged fittings, fuel nozzle connections, poppet valves and fuel line tubing for Diesel engines; a revision of the standard ignition distributor mountings and a new standard for 14 mm. spark plugs for gasoline engines.

Fan belt manufacturers have a Committee studying standardization of fan belts and pulleys whose report is to be submitted to the Gasoline Engine Division. The industry has been surveyed as the basis for standardization of replaceable valve seat rings and the mountings and connections of transmission gear boxes to the clutch housing.

In the motorboat field, the most recent development is a critical review of the shaft and propeller wheel mounting standards by the manufacturers, to bring these standards into line with present practice for both gasoline and Diesel power plants.

Another important project is the modernizing of the S.A.E. spline fitting standard, the probable inclusion of the side bearing type and the possible coordination of the entire standard in a national program for all mechanical industries.

Possibly three of the most important projects now being completed which affect the automotive industry are the refinement of the standards for screw threads and the adoption on a national basis of a definite standard for wrench-head bolts and nuts.

In International standardization, the principal projects in progress relate to anti-friction bearings and tires and rims. Other projects in progress for dimensional standardization machine pins and plain and lock washers by Sectional Committees for which the Society is a sponsor under American Standards Association procedure.

Materials Specifications

In the non-ferrous metals field, the Society has just adopted the revised specifications for aluminum alloys and for brass and bronze alloys, together with new specifications for aluminum and zinc base die casting metals. Work is in progress on specifications for magnesium alloys and nickel bronzes and general introductory notes and information bearing on the several non-ferrous metal specifications. In the field of ferrous metals, the Iron and Steel Division is surveying the use of chrome-nickel molybdenum and 3½ per cent nickel-molybdenum steels and will consider specifications for cast irons and possibly special steels for aircraft use. The results of some work have been published in the Handbook on methods of indicating physical properties of steels by the so-called "probability method" which is likely to be further developed by the Division, as conditions permit, to replace the present physical property charts for these steels in the S.A.E. Handbook.

Committees are being organized for or are now engaged in studying improved standards for brake linings and felts, while the principal activity in the petroleum field is towards establishing definite classifications for greases and lubricants for motor vehicle chassis.

Tests, Codes and Ratings

The standard engine testing forms are being studied with a view to including more accurate barometric and temperature correction formulas for use in testing airplane engines. Important developments are being made in improved laboratory testing specifications for automobile head-lamps to supersede those in use for several years.

In this connection, plans are in progress for developing suitable means on a national scale to bring about greater safety in night driving as affected by headlighting and to encourage better maintenance of automobile headlighting

equipment in the hands of the vehicle operators.

Another important project in the vehicle operating field is development of cost record forms for motor vehicle fleet operation, the intention being to incorporate these in the present, widely used S.A.E. Recommended Practice for uniform motor vehicle operating cost classification.

In the motorboat field, consideration probably will be given to endorsement of a code for fuel installation and safety systems that has been drafted by the motorboat industry.

A telegraphic code for iron and steel specifications and a code for color marking of standard steel bars are scheduled for early consideration. Some study has already been given to a code for the design and testing of shock absorbers.

The Society is also cooperating in the preparation of standard codes for automobile brakes and brake testing, drafting room practice, foundry equipment and supplies, and acoustical measurements and terms by means of Sectional Committees under American Standards Association procedure.

Special committees of the Society are preparing to issue recommendations, one with regard to dimensional and weight limitations for motor trucks in connection with their regulation by States, and the others on rating motor trucks by a standard method to be tried out by the truck manufacturers.

Manufacturing Practices

The Society's activities in this field are at present mostly directed to projects for the standardization of tools, machine tool elements, fixtures and similar types of manufacturing equipment. This work is being carried forward by a Sectional Committee under the procedure of the American Standards Association on a national basis. A new project, however, is that for definition and classification of surface finishes on different materials obtained by different methods of work such as surface removal, plastic operations, coating and plating.

Motor Transport Projects

An important project, plans for which are now being formulated, looks toward standardization of gasoline tanks and tank trucks in cooperation with the American Petroleum Institute, both with regard to the present type of motor trucks and new types that may be developed as the result of new motor vehicle regulations enacted by the several States.

Definite progress in standardization is hoped for this year as regards interchangeability of tractor semi-trailer couplings between different makes. A survey of the use of the Society's present chassis record form, that is a service record for fleet operators, is to be made and a definition of what constitutes a standard truck chassis will probably be adopted soon.

Chairman

Arthur Boor
Heads standards work again

Radio Equipment

Last fall the Society entered into a new field of standardization activity by a cooperative program with the Radio Manufacturers Association for the standardization of radio equipment for automotive installation. This work is progressing rapidly and definite recommendations will probably be approved before long.

Nomenclature

The only work in progress in this phase of standardization is for Diesel engines, for which it was felt there is distinct need for the establishment of definite descriptive terms. The present automobile nomenclature is revised from time to time where it relates to groups of terms such as electrical equipment, and it is possible that a general review of the entire standard may be made this year to bring it up to date and to include terms for new developments such as four-wheel brakes, freewheeling devices, superchargers and so on.

Miscellaneous

A recommended practice is nearing completion in the Lighting Division for use as a guide for location of the various types of lamps used in automobile construction, the voltage and candlepower of incandescent lamps used in each location and general notes relative to the installations.

Work is also in progress in Sectional Committees on which the Society is represented on definitions of technical terms, electric welding, machine tool safety code, geometric series of preferred numbers such as those for use in determining the progression of sizes, scientific and engineering symbols and abbreviations and the use, care and protection of abrasive wheels.

Designation for S.A.E. Standards

For a number of years S.A.E. specifications have been designated as S.A.E. Standard or S.A.E. Recommended Practice. The Standardization Policy Committee is considering the simplification of the method of designating specifications in view of the real intent of some of the standards as distinguished from that indicated by the status designation.

As the standardization work of the Society progresses, it will be reported in various issues of the S.A.E. JOURNAL for the information of the membership at large and to afford opportunity of submitting comments and suggestions on proposed specifications before their final adoption by the Society.

It is hoped that members will communicate with the Society's office regarding standardization projects as reported from time to time, so that the Committees will have the benefit of broad consideration of projects before final adoption.

Publication of Standards

The new and revised standards and recommended practices adopted by the Society at its Annual Meeting in January will be issued to the members as soon as they can be printed for general distribution—probably this month. Likewise, specifications approved and adopted at the time of the Summer Meeting this year probably will be issued to the members as heretofore, so that all of the standard specifications of the Society will be in wide circulation in the automotive and allied industries.

News of the Sections

FEBRUARY brought good crowds to most Section meetings from which word of any kind has come in. Milwaukee, Metropolitan, Northwest, New England and Southern California reports came in with a fullness and a promptness which permitted the individual digests and news items which appear below.

But plenty of other Sections had equally successful sessions. Detroit proved that there is something new under the section-meeting sun by staging a Ladies' Night featured by a big fashion show.

Indiana changed its meeting place to the "Atheneum," got D. G. Roos, Studebaker's engineering chief, to give frankly and informally his very definite opinions about the designs which appeared at recent European and American shows, and thereby boosted its attendance back to old time high marks. Section Nominating Committee appointed by Indiana, incidentally, includes: Lee Oldfield, Wm. Guy Wall, Chester Ricker, Ralph R. Teetor, H. M. Jacklin, Louis Schwitzer, and Harold Caminez.

Wolf Talks Twice

Both Syracuse and Cleveland heard Austin Wolf discuss in person the automotive design developments of 1933, about which he had written so brilliantly in the January S.A.E. JOURNAL, while at the Washington Section, Dr. Dickinson, fresh from an afternoon presentation of his "Mechanics of Recovery" ideas before a Senate committee, discussed this same topic, amplifying somewhat his Annual Meeting paper printed in the February S.A.E. JOURNAL.

The Cleveland Section Nominating Committee was chosen as follows: A. T. Colwell, T. S. Kemble, O. A. Parker, A. J. Scaife, K. D. Smith, Hoy Stevens, N. F. Squire, and G. D. Welty.

With General Manager John A. C. Warner presiding, the Philadelphia Section staged one of the most successful and least-reportable meetings in its history. Reporters were barred, automotive design was dissected from every angle and engineers spoke their minds with freedom. Chief talkers were P. M. Heldt and Joseph Geschelin, engineering editors of *Automotive Industries;* Walter O. Graff, E. G. Budd Co.; C. O. Guernsey, J. G. Brill Co.; Edmund B. Neil, N. W. Ayer & Sons Co.; and James W. Cottrell, technical editor of *Commercial Car Journal.*

Philadelphia too has changed location of meeting place, new quarters being at Engineers' Club. Section Nominating Committee chosen was: A. Gelpke, L. E. Lighton, Joseph Geschelin, H. F. Huf, and H. B. Coleman.

Chicago drew over 150 members and guests to a dinner meeting, at which William Stout showed what's wrong with car design and Norman G. Shidle urged greater participation by engineers in the non-technical phases of industry. F. K. Glynn, of American Telephone and Telegraph Co., was toastmaster.

Buffalo was scheduled to hear about the new Stewart-Warner power brakes from Thomas M. Nevein, engineer of that company, and about various new types of brake drums from George Cockayne, of Kelsey-Hayes Wheel Corp.

The February program in Baltimore featured Lt. Col. Brainerd Taylor on motor transport from the standpoint of the U. S. Army, and L. C. Major of Pennsylvania Greyhound lines on legislation of the future and its effect on large and small motor vehicle operators.

Amos Northrup, Murray body designer, was scheduled to give a chalk talk on future body design to the Canadian Section for its February gathering.

Eells and Horning Evaluate Designs

Road Show Products Reviewed; Radical Car Design Is Urged

TWO speakers gave their opinions of current design trends at the February meeting of the Milwaukee Section which brought an attendance of over a hundred.

Past President H. L. Horning, of Waukesha Motor Co., spoke on "What's New at the Automobile Shows." C. W. Pendock, president of Le Roi Co., told "What's New at the Road Show."

Mr. Pendock stated that very few major changes are evident in road machinery this year but the matter of details is having close study. A new spherical universal joint built in Detroit appears to have considerable merit as high load capacity with low power loss and excessive angularity tends toward an ideal joint, although it is not designed for "an out of parallel condition."

A four-stage "Snow Pump" created considerable interest, Mr. Pendock said, in that an adjustable blade scoops the snow into a series of centrifugal blowers and throws the snow an appreciable distance from the highway. An independent drive is employed to insure constant speed and to eliminate the variables encountered when in series with the traction drive.

The large number of hydraulic controls are difficult to explain in view of their slow speed as compared to mechanical means, he said.

A new type of concrete handling equipment, in which the expensive tower and chute construction is replaced by pumps, has remarkable possibilities, Mr. Pendock thinks.

Horning Urges Changes

Mr. Horning lamented the throttling of engineering progress by tradition and pointed out that only one car—Pierce Arrow—this year really tends toward the necessary and ultimate "tear drop" lines. He praised those companies who have been willing to forget momentary sales resistance in an effort to build a better product.

Mr. Horning appealed for more engineering progress, urging such innovations as powerplants placed in the rear, bodies with minimum wind resistance, automatic gear shifts and so forth.

The VEE flight of geese, the shapes of fish, boats and bullets, were employed to demonstrate the importance of eliminating the waste of 15 hp. to propel a pair of present day head lights at 90 m.p.h.

Although admitting appreciable "invisible progress" in springs, inserted valve seats, along metallurgical lines, he stated "that Sacred Cow, the rear axle, is doomed because of excessive weight." The traditional gear shift lever will disappear and be replaced by an automatic torque adjusting transmission, he believes.

Although this year's shows are typical of the times of selling for less than cost, considerable improvement in details is evidenced by the more universal adoption of 14 mm. plugs, "lower growth iron" in blocks, cast iron crankshafts, spring surge devices, smoother engines, air cleaners, quiet fans, floating power, cross flow radiators, and mufflers with minimum back pressure.

Considerable recent European diesel activity is attributed by Mr. Horning to the greater

price differential in fuels there, but trucks and agricultural machinery in this country may soon employ more of this type, according to Mr. Horning.

Messrs. Eells, Dick, Frudden and Ritchie took part in the discussion.

California Called World Leader in Engineering

California is leading the world in the number and magnitude of engineering projects now under way, according to W. A. Simpson, president of the Chamber of Commerce of Los Angeles, who talked to the February meeting of the Southern California Section. Forty miles of harbor have been built in the last ten years, he said, and described in some detail the work which had been accomplished on such major construction projects as the San Gabriel Dam, the Metropolitan Water District, the Hoover Dam, the San Francisco Bay Bridge and others.

A full description of Ethyl gasoline and its properties by Sanford M. Wagner, division manager, Ethyl Gasoline Corp., finally led to a general discussion of individual fuel problems, air wheels, streamlining and automobile maintenance problems in general.

The following Section Nominating Committee was named: Eugene Power, chairman, Rolla W. Moore, Fred C. Patton, C. T. Austin, and Melvin N. Lefler.

Argument on Welding at Northwest Meeting

Use in Building Up Valve Seats Disputed. Metal Spraying Topic

The statement that manganese bronze welding is successful when used to build up valve seats, brought about a dispute at the February meeting of the Northwest Section, where Floyd R. Belcher, Air Reduction Sales Co., talked on "Welding and Cutting", and Howard A. Lohman, DeLaval Steam Turbine Co., discussed "Metal Spraying".

The questioned statement was made by Mr. Belcher, who, during the discussion, amplified his remark by adding that manganese bronze welding is best adapted when used on small valves. He pointed out, too, that a neutral flame is essential to avoid oxidizing the copper in the metal mixture.

One of the new developments in testing tensile strength of welds, Mr. Belcher said, is a pulling machine which is now being widely used. He pointed out that X-ray tests are required in some instances, but added that a man's experience tells him much about the character of the material to be welded in addition to the fact that a number of very simple tests are available. He described the wide variety of uses to which oxy-acetylene welding processes now are applied and showed how such processes have proved their worth through years of development.

The Lohman paper was devoted largely to a discussion of a spray gun now manufactured in America, but patterned after a German design which has been in use for years. Mr. Lohman showed samples of spraying and of rods used for feeder material. Good success is attainable with any metal that may be obtained in wire form, he said, and the building-up process can be carried as far as desired.

The process which Mr. Lohman described was first used in Germany in 1882 for spraying pulverized lead. It simply sprays molten metal, he said, to coat surfaces of wood, metal or other materials. The mechanism includes an air turbine which supplies drive power through reduction gears in the gear case to two knurled wheels which feed the metal wire into the oxy-acetylene flame. As the flame melts the wire, an air blast atomizes and impacts the metal against the surface which is to be covered. The molten particles instantly solidify and form a bond with the surface, which must first have been carefully cleaned by sand blasting. The wire feed synchronizes with the 6300 deg. fahr. flame heat and with the air blast.

Adhesion of the metal is similar to electroplating, Mr. Lohman said, the bond being due to the indentations which form cavity contacts. Costs of coating a surface of one sq. ft., .001 in. are: with a 12 gage gun; lead, 2 cents; tin, 5 cents; aluminum, 2 cents; bronze, 3 cents; and stainless steel, 7 cents.

The Section Nominating Committee was appointed at this meeting, C. F. Bolin being made chairman.

Met-Aeronautic Hears Lewis and Gassner

Cooperating with the Marine Division, the Aeronautic Division of the Met Section of the S.A.E. met on Thursday evening, February 16 at the Hotel New Yorker, New York.

The first speaker to be introduced by Walter Peper, Vice-Chairman of the Section, was Dr. George Lewis of the National Advisory Committee of Aeronautics. Dr. Lewis brought home forcefully the importance of the research work being conducted at Langley Field. By figures derived from the results of wind tunnel experiments, he first pointed out the necessity of proper location of the engine wing nacelles on multi-engine ships. The figures indicated the DOX to be a poor installation and that of the new Martin Bomber an excellent one.

Three transport ships now under construction, the multi-engined Sikorsky and Martin-transports for Pan-American Airways—and the Curtiss-Condor for Eastern Air Transport, have closely followed in design the results of the Langley Field tests. Numerous slides showing both old and improved type of transports were shown and by the comparison of each with the charts of tests one can see how efficiency in airplane design is improving. To this increased efficiency Dr. Lewis attributed to the gain in business and the steady upturns in air transportation even in the times of economic stress through which we have been passing.

One slide showed how the simple matter of placing the rivets on the upper surface of a metal covered wing might affect the efficiency of the ship and mean a great saving or a loss if not done properly.

Alfred Gassner, Chief Engineer of the Zap Development Corp. of Dundalk, Md., then presented a prepared paper. However, his actual talk was confined to the slides and a reel of film he brought with him. The first slides dealt with a series of Lift drag curves, constituting the fundamental ideas surrounding the wing flap development leading up to the perfection of the Zap flap. Installation of the unit was shown on a Navy Observation Ship and a moving picture showed this ship in action. Temple Joyce, of international fame as a test pilot, showed the remarkable safety of the ship in the gyrations performed for the camera man who made the film. Close-ups of the installation on the Navy Ship with the flap and ailerons in motion were most interesting. The aileron development necessitated by the wing flap on both wings of a biplane and on the one wing of the monoplane presented some very interesting problems shown by graphs and pictures on the slides. The final location of the aileron was found to be best above and to the rear of the flapped wing.

Another section of the film was devoted to the tests of a General "Aristocrat" four-place cabin monoplane equipped with flaps. The ship was shown approaching the landing field in a steep glide yet with the flaps extended it did not accelerate and came to a perfect landing much like an autogyro. Its other "trick" performances made shivers go down the spines of experienced pilots present, but Mr. Gassner assured them that it was all in a day's work when your ship has Zap flaps. The latest two

A Candid Camera Does Its Stuff

L. V. Newton, Chicago Section Chairman (at extreme right) confers with toastmaster F. K. Glynn and speakers just before oratory starts at Chicago Section Automobile Show Dinner. This year the dinner took place Jan. 31. (From left to right) John A. C. Warner, William B. Stout, Curtis C. Stewart, F. K. Glynn, Norman G. Shidle, and L. V. Newton.

Northrup ships—one for Lieut.-Com. Frank Hawks and the other for the Ellsworth Antarctic Expedition—are both equipped with flaps. For commercial transports the flap permits the new high speed ships to land and meneuver at low speeds without the usual attendant dangers of a fatal stall.

The meeting was well attended and the discussion of both papers brought the meeting well past ten o'clock before Chairman Dutcher adjourned the meeting.

Crouch Reviews Speed Boat Design

Cooperating with the Aeronautics Activity Division of the Met-Section at the S.A.E. Meeting on Thursday evening, February 16 at the Hotel New Yorker, both the members engaged in marine and aeronautical activities were given a most instructive talk by George F. Crouch, internationally known naval architect, who with an interesting series of slides, ran through the history of high speed motorboat design in the United States. The earlier slides were more or less sketchy because they followed through rapid periods of development in both hull and engine and it was only with the institution of the Gold Cup Races in this Country that a very definite competitive element in design began.

At first the fast ships more generally followed the lines of step hydroplanes but later on when the speeds of these boats and the power installations became unwieldy, the rules of the Gold Cup Race Committee specified the use of "displacement boats," that is, no steps on the bottom of the hull were permitted, but it was only natural that these boats would plane on the top of the water as the speed increased.

One of the earliest models developed by Chris Smith was particularly successful and then followed the boats that have become internationally famous, such as, Baby Bootlegger, Greenwich Folly, Hotsy Totsy, Imp and the last year's winner, Delphine.

Some very interesting sidelights on the increase of the speed of these older boats in recnt years was given by Mr. Crouch through the slides showing the attachments of shingles on the bottoms of these boats which are really steps of approximately ⅞ in. depth. Mr. Crouch, in discussing the development of some of these high speed boats, especially that of Chris Smith's fast boat, said that in all probability no drawing ever existed of this particular boat inasmuch as all of the earlier stages of design were conducted by models and since the final boat was built according to the shape which the model tests showed to be most satisfactory.

The interest with which the paper was received was indicated by the incessant questions being asked by the audience as the slides were being shown. Mr. Crouch's replies at many times were very humorous and it is apparent that every one present appreciated Mr. Crouch's efforts.

Appoints Engineers

S.A.E. Members played an important part in the 1933 committee appointments recently announced by G. L. Brunner, president of the Motor and Equipment Manufacturers Association. Important committee appointments which have been given to Society members in the parts makers association include that of David Beecroft as a member of the executive and also of the committee on legislation; C. C. Carlton, as a member of the finance committee; F. G. Wacker, as a member of the finance committee, and E. E. Husted as a member of the National Automobile Shows committee.

Radius Rods Urged in Place of Kick Shackles

In N. E. Talk, Fales Cites Reasons for Use in Europe

Use of radius rods for front axles instead of the usual kick shackle construction was urged upon American car makers by Dean A. Fales, associate professor of automotive engineering, Massachusetts Institute of Technology, at the February meeting of the New England Section.

Important European makers, Professor Fales pointed out, including Invicta, Delage, Alpha-Romeo and Mercedes, already use radius rods for front axles. The radius rods, Professor Fales said, not only position the front axle, but also in some cases care for the braking torque. They tend to improve steering stability and make braking more effective. He suggested that this type of construction is better than a kick shackle installation because his experience in testing cars indicated that considerable wandering occurs when kick shackles are used because the front axle does not remain in a position at right angles to the frame.

Professor Fales covered many other elements of current design problems including independent wheel springing, hydraulic clutches and transmissions and various types of European body construction. Throughout his paper, in fact, he paid special attention to recent and past European developments.

The meeting was attended by sixty members and guests. The following were chosen as the Section Nominating Committee: F. E. H. Johnson, K. T. Brown, W. M. Clark, R. F. Lybeck, and D. A. Fales.

McPhail Talks on Bearing Lubrication

K. R. McPhail, automotive engineer of the Standard Oil Co. of California, was the speaker at the Jan. 6 meeting of the Southern California Section and his topic was Journal-Bearing Lubrication. Sixty members and guests were in attendance, and 53 were present at the members' dinner in the Richfield Building cafeteria preceding the technical session.

Following Mr. McPhail's presentation of his subject, it was discussed from the floor by C. H. Jacobson, J. Jerome Canavan, Carl Abell, M. Scott, W. E. Powelson, C. T. Austin and E. R. Jackson.

Charles Bayly Franklin

Information was received with sincere regret early in December of the sudden death of Charles Bayly Franklin, chief engineer of the Indian Motocycle Co., of Springfield, Mass., which terminated 18 years of service with that company and its predecessor, the Hendee Mfg. Co.

Mr. Franklin was born at Dublin in 1880, secured his technical education in physics, chemistry and electricity at St. Andrews College and the Royal College of Science in Dublin, and took a special course in electricity, the Institution of Electrical Engineers conferring upon him the degree of master of arts in electrical engineering in 1897.

Mr. Franklin's professional career began in 1901, when he entered the Pembroke Electrical Works as a premium pupil. He came to America in 1916 as assistant mechanical engineer for the Hendee company and since then was successively design and research engineer, production and design engineer and, from 1929, chief engineer of the company. During the World War he was temporarily employed by the motors division of the production and engineering branch of the Quartermaster Corps.

Mr. Franklin was elected to Member grade in the Society in May, 1918, and since 1919 was Affiliate Member Representative of the Indian Motocycle Co.

Aage Winckler

Aage Winckler, president, Winckler Engineering Co., died suddenly at his home in Milwaukee, Jan. 25, 1933.

Born in Copenhagen, Denmark, 51 years ago, he received his technical training in Zurich, Switzerland, and his engineering degrees at Karlsruhe, Germany. He then entered the employ of Delaunay-Belleville in Paris, France, and in 1906 founded and operated the first taxi system in Copenhagen. He himself drove the first taxi from Cologne, Germany, to Copenhagen, which at that time was considered a remarkable accomplishment.

He then came to America to associate himself with the J. I. Case Co., Racine, Wis., where he became their chief engineer. In 1917 he formed the Winckler Engineering Co., Milwaukee, Wis., to design and develop automotive and airplane motors and accessories. Under his direction an oil injection unit on the Diesel principle was developed applicable to small high speed automobile and airplane motors.

William Brookes

With profound sorrow Ferodo & Asbestos, Inc., of New Brunswick, N. J., announced the death of its president, William Brookes, on Dec. 31, 1932. Mr. Brookes was the Affiliate Member Representative of the company in the Society since 1926.

Mr. Brookes came to the United States eight years ago to represent English principals against great odds and, in a highly competitive field, built up an outstanding business. Because of his high-minded business ethics and qualities of leadership, he was elected to the presidency of the Asbestos Brake Lining Association, which on Jan. 11 passed a resolution expressing regret and extending sympathy to Mrs. Brookes and his former associates.

Clarence E. Whitney

With deep regret the industry learned of the passing of Clarence E. Whitney, famed for his many years of work on bicycle, automobile and other high-speed chains for power transmission, on Jan. 22.

Mr. Whitney had been engaged in the chain and machine-tool business since 1890, for the first six years with the Pratt & Whitney Co., and since then as president and general manager of the Whitney Mfg. Co., of Hartford, Conn., and was responsible for introducing many improvements in drive chains. He was born at Hartford in 1869 and received his engineering education at the Massachusetts Institute of Technology. He was one of the early members of the Society, and his application for membership, filed in October, 1908, named as personal friends for reference purposes the following other early members: A. L. Riker, Henry Ford, Hiram P. Maxim, H. W. Alden and Walter C. Baker.

What Members Are Doing

Church Becomes Winton Engine Vice-President

H. D. Church has just become vice-president in charge of engineering and manufacturing of the Winton Engine Corp., Cleveland, according to an announcement made by G. W. Codrington, president and general manager. He resigned recently as vice-president in charge of engineering of White Motor Co., with which organization he had been associated since 1925.

Mr. Church, who was elected to Member grade in the Society in 1911, has been connected with the automobile and motor-truck industry from its early days and he has long been recognized as a leading authority on motor-truck engineering. He became directing engineer of the White company in 1925.

In 1925 the Society elected him Second Vice-President representing motor-car engineering, and he served in 1931 on the Motorcoach and Motor-Truck Committee and in 1932 on the Automotive Transport Code Committee. He contributed the following papers at meetings of the Society that have been published in THE JOURNAL: Double-Side-Chain Final Drive, Military Influence on Motor-Truck Design, Refinements and Generalities in Truck Design, and Internal Wheel-Brakes for High-Speed Heavy Vehicles.

F. K. GLYNN and J. F. WINCHESTER were speakers at the February meeting of the Automotive Service Association of New York City. Mr. Glynn and Mr. Winchester both spoke on Controlling Cost Factors in Fleet Maintenance.

HUGH A. GILLIES was recently appointed vice-president in charge of sales for the American Brakeblok Co., Detroit. Previously he was sales manager.

JULIAN CHASE, a member of the Society for the last 25 years, has recently returned to the directing editor's chair of the Chilton publications, after serving as business manager of *Automotive Industries* for the last five years.

DONALD BLANCHARD, who has been editor of *Automobile Trade Journal*, has been made editor of *Automotive Industries*, another Chilton publication. Mr. Blanchard has been with the Chilton organization for many years, having previously been editor of *Commercial Car Journal* and a member of the staff of *Motor World*. He has been active on Society committees, particularly in the transportation division.

J. B. ROSENQUEST, who has been General Motors Truck Co. sales manager in New York, has been transferred to the Philadelphia offices of that company.

W. S. PRITCHARD, former development engineer with the Doehler Die Casting Co., Toledo, is now connected with the Bundy Tubing Co., Detroit.

RALPH BAGGALEY, JR., former assistant engineer of equipment for the Pennsylvania Department of Highways at Harrisburg, Pa., is now connected with the McCrady-Rodgers Co., of Braddock, Pa.

LOUIS CROSET, a Foreign Member of the Society, has recently been engaged as chief designer, Diesel division with Minerva Motors S. A., Antwerp, Belgium. Mr. Croset previously was chief engineer, Diesel department, Sentinel Waggon Works, Ltd., of Shrewsbury, England.

Meetings Calendar

Baltimore—March 16

Emerson Hotel; Dinner 6:30 P. M.

Canadian—March 15

Royal York Hotel, Toronto; Dinner 7:00 P.M.

Chicago—March 7

The New A-B-C in Clutch Design—E. E. Wemp, Engineering Counsel, Long Mfg. Co.

Cleveland—March 13

Cleveland Club; Dinner 6:30 P.M.
Diesel Engines—Joseph Geschelin, Engineering Editor, Automotive Industries

Dayton—March 16

Engineers' Club of Dayton; Dinner 6:30 P.M.
Glass—Laminated and Otherwise—R. A. Miller, Technical Sales Engineer, Pittsburgh Plate Glass Co.

Detroit—March 7

Inspection of the U. S. Rubber Company plant at 6600 E. Jefferson—6:30 to 8:30 P.M.

Indiana—March 9

Inspection of Ball Bros. Glass Works, Muncie, Ind., 3:30 P.M. Dinner 6:30 P.M.; Meeting 8:00 P.M.
Automatic Transmissions—S. O. White, Chief Engineer, Warner Gear Co.

Metropolitan—March 8

Hotel New Yorker; Joint meeting with American Society for Testing Materials. Afternoon session at 2:00 P.M.; dinner 6:30 P.M.; evening session 8.00 P.M.

Session at 2:00 P.M.

Present Concepts of the Relation of A.S.T.M. Pour Test to Service Requirements of Oils—J. L. McCloud, Metallurgical Chemist, Ford Motor Co.

Viscosity of Automobile Crankcase Oils as Related to Service Requirements—E. W. Upham, Chief Metallurgist, Chrysler Corp.

Carbon Deposits in Gasoline Engines—W. A. Gruse, Senior Industrial Fellow, Mellon Institute of Industrial Research

Service Charges in Crankcase Lubricating Oils—M. A. Dietrich, Chemist, De Laval Separator Co.

Session at 8:00 P.M.

Oil Consumption in Motor-Car Engines W. H. Graves, Chief Metallurgist, Packard Motor Car Co.

Factors in Engine Design which Affect Oil Performance—A. L. Clayden, Research Engineer, Sun Oil Co.

Airplane Lubrication—Arthur Nutt, Vice-President in charge of Engineering, Wright Aeronautical Corp.

Milwaukee—March 1

Milwaukee Athletic Club
Speaker: Alex Taub, Development Engineer, Chevrolet Motor Co.

New England—March 8

Walker Memorial, Massachusetts Institute of Technology, Cambridge; Dinner 6:30 P.M.

Northern California—March 14

Elks Club, San Francisco—Dinner 6:30 P.M.
Subject: Research

Northwest—March 3

Bergonian Hotel, Seattle; Dinner 6:30 P.M.
Hedges Two-Way Engine

Oregon—March 3

Multnomah Hotel, Portland; Dinner 6:30 P.M.

Philadelphia—March 8

Tour through Ford plant in Chester. Production will be the subject of the meeting following the inspection trip

Pittsburgh—March 21

Fort Pitt Hotel; Dinner 6:30 P.M.
Extreme Pressure Lubricants—H. C. Mougey, Chief Chemist, General Motors Corp.

Southern California—March 18

Jonathan Club, Los Angeles; Dinner 6:30 P.M. Entertainment
Annual Dinner Dance

Syracuse—No Meeting

Washington—March 13

Racquet Club, Washington, D. C.; Dinner 6:30 P.M.

Three Low Priced Cars Vary in Riding Comfort

In carefully controlled tests, Doctor Moss shows one low priced car superior in comfort to two others

THREE different methods of test all rated three low priced cars in the same order as regards riding comfort in a series of experiments conducted on five people by Dr. F. A. Moss, of George Washington University.

Wabblemeter, metabolism and reaction-time tests were used.

Doctor Moss, who has been conducting investigations of this kind for several years under the guidance of the Riding Comfort Subcommittee, told about these most recent tests in dramatic fashion during the annual meeting. He said in part:

The tests were made on five subjects after riding in the three cars designated as Car A, Car B and Car C. Test conditions may be described as follows:

Cars—The current model four door sedan was used for each of the three makes of car. Each of the cars had been driven approximately the same number of miles (about 2500). Each was maintained and serviced by its own dealers. The same kind of gasoline was used in all the cars.

Subjects—The same subjects were used throughout the tests: Three males, aged 41, 25 and 14; and two females, aged 28 and 22. Each subject went through a series of practice tests before the riding tests began, the purpose being to eliminate the marked practice effect which would occur were the subjects unfamiliar with the tests at the beginning of the tests after riding. At the end of the whole test series, "normal" records were obtained for each of the instruments by taking measurements at the exact time of day of the riding tests, the intervening time being spent leisurely instead of in riding. Living conditions, including such things as food, sleep, and activities after the rides, were controlled during the tests. Four of the subjects participated in all of the trips, but one participated in only the last cycle of three days. Two of the subjects made all the rides on the front seat, and two made all on the rear seat. The same man did all the driving.

Route—The route for the test rides consisted of a circuit of approximately 100 miles. It was selected so as to include varying types of road. The complete route was covered on two trips a day, the first starting at 8:30 a.m. and the second at 12.30 p.m. A third trip was made each day, starting at 4:00 p.m. and differed from the first two in the omission of a 12-mile part of the trip.

Driving Speed—For the first five cycles, all the trips were made at a speed of 40 to 45 m.p.h. On the sixth cycle, the first two trips were made at a speed of 50 to 55 m.p.h., and the third trip was made at an average speed of 25 m.p.h.

Order of Trips—Each of the three cars was used in six cycles of three trips each. As the traffic is heavier on some days in the week than on others and a 300-mile drive through the heavy Sunday traffic might be much more fatiguing than a 300-mile drive through the light Tuesday traffic, it was arranged so that each of the three cars would be tested on a different day of the week but all would eventually be tested on the same days of the week. The order of cycles was as follows:

Cycle	1	2	3	4	5	6
Monday	B		C		A	
Tuesday	A		B		C	
Wednesday	C		A		B	
Thursday		A		B		C
Friday		C		A		B
Sunday		B		C		A

The mixed order was also used to eliminate any practice effect which might accrue from a car being used first or last in a cycle.

Results of the Tests

(1) *Subjective Ratings*—Without letting the subjects know how the actual test results were turning out, each subject was asked at the end of each separate cycle to rate the three cars according to his subjective estimate of their riding qualities. There was a general agreement from the first in rating Car C as the poorest, but both Cars A and B received ratings as the best. However, 80 per cent of the subjective ratings placed Car A first and Car B second. Car C was placed as poorest in 100 per cent of the subjective ratings.

(2) *Objective Ratings*—The fact is generally recognized that a person's subjective opinion is subject to considerable error and is influenced by all such factors as weather conditions and incidental happenings on a trip. Therefore we do not attach much importance to those subjective estimates, but give them for what they are worth. Instead, we base our conclusions on the results shown by the impersonal instruments.

(a) *Wabblemeter Results*—It is known that when an individual first gets out of the car after an automobile ride of more than 100 miles, he feels as if he had "sea legs" under him, and consequently his bodily unsteadiness is very much increased. The longer the ride is, the more unsteady he becomes; and the

more shaking, bumping and jolting he is given by the car in which he is riding, the more unsteady he will be when he gets out. To measure this unsteadiness, the instrument described earlier was used. The technique followed in taking the wabblemeter reading was that described in the S.A.E. JOURNAL for September, 1931, p. 245. Two tests of 1 min. duration each were taken on each subject, a stop-watch being used for accurate timing. No conversation was permitted during the test and persons were not allowed to move in the field of vision of the one being tested. The tests were always taken immediately after leaving the car and the subject always adopted the same posture on the instrument.

Tests were taken at the end of each trip. The first trip, consisting of 107 miles, was begun at 8:30 and ended at 11:30 a.m. The second trip, over the same route and distance as the first, was begun at 12:30 and ended at 3:30 p.m. The third trip, consisting of 95 miles, was begun at 4:00 and ended at 6:30 p.m., with the exception of the last cycle for each car, when the slower speed was used for the last trip. In this case the last trip ended at 7.10 p.m.

There was a clear cut difference between the cars, the 1854 miles in Car A causing a total of 2440 wabbles; in Car B, 2679 wabbles; and in Car C, 2718 wabbles.

The average percentage change from normal after riding in Car A is 42 per cent; in Car B, 56 per cent, and in Car C, 58 per cent. Thus it appears that Car A shakes one up less than Car B, and Car B less than Car C.

(b) *Metabolic Results*—The metabolism of the living body represents the amount of energy the body is producing at a given time. In a word, it shows how much energy a given activity is taking out of the person. Since the energy is influenced by the quantity of food one eats and the time at which he eats it, the quantity of food and the time of eating were kept constant for our subjects. At the end of each day the subjects were given metabolism tests to determine how much energy was being taken out of the individual by each day's ride. The results of the three cars were recorded on the same chart, using inks of different colors. Metabolism tests were taken after four of the six cycles.

The conclusions of this part of the test are convincing and show that, in general, a 309-mile ride in Car A takes less out of the individuals than the same ride in Car B or Car C.

(c) *Reaction-Time Test* — That the speed of a neural impulse is influenced by fatigue is generally recognized. In general, the more fatigued the person is, the slower will be his reaction time. This is of considerable importance from the viewpoint of safety in automobile driving, especially when an individual faces a dangerous situation and finds it necessary to move his foot from the accelerator to the brake in order to avoid an accident. A difference of a fraction of a second in speed of reaction may and often does mean the difference between an accident and the avoidance of one.

For measuring the reaction time, we used the instrument devised for this purpose as previously described. The average results for all reaction-time readings for the various cars were:

Reaction Times of Drivers after Trips, in Moving Foot from Accelerator to Brake Pedal

Driver of	Time Expressed in Sine Waves	Seconds
Car A	3.74	0.23
Car B	3.91	0.27
Car C	4.23	0.31

It will be noted that Car C was by far the poorest in this respect. Part of its poor showing may be due to the way the accelerator is arranged in respect to the brake, but, regardless of the cause, a driver apparently would be more competent to meet an emergency if driving Car A.

Super-Balloon Tires—Retrospect and Prospect

Early in 1932 the super-balloon program was to market a large section, low pressure tire for field replacement on light cars, with the intent to stimulate tire sales through novelty of appearance and, second, to provide, if possible, a softer and more acceptable tire-ride for the car owner. The tire companies, who sell tires to the car makers, who try to understand and consider car problems as influenced by tires and whose reputations are judged on the quality and soundness of their experimental developments, did not force the movement toward the big tire, until field competition compelled them to do so. The lesson of 1923 had not been forgotten entirely. The impetus for the super-balloon movement came from without the original equipment circle. Once launched in the field, however, the impulse to get business was strong enough to stampede practically all tire makers headlong into making replacement tires without enough thought to expense or other consequences.

Unquestionably a great deal of tire development experience had been gained before the big tire made its appearance even by tire companies who were reluctant at first to participate in the super-balloon program. However, experience was lacking, as afterward proven, in the degree of satisfactory performance the tire would transmit to cars of all makes, ages and degrees of maintenance.

Replacements Were Mistake

It is clear now that a mistake was made in trying to introduce the larger tires as field replacements. The job of getting the facts about car performance on super-balloons, as well as the comparative cost and the relative tread life of the tire itself should have preceded any introduction. If, as was true, car engineers had troublesome front-end design problems with standard tires, how could the same vehicles be expected, even when new, to perform as well on much larger sections? While it is true that the big tire was adapted to a limited number of new and partially re-engineered cars, with some success, nevertheless even those car engineers, whose product performed reasonably well on super-balloons were antagonized by the replacement method of introduction. The difficulty of solving the problem presented to the engineers is indicated by the fact that the proposed increase in tire sections of the super-balloon in 1932 was greater in most instances than the summation of all the increases of sections from 1923 to 1932.

A second serious mistake was in offering for substitution such a large oversize as a 9.00 inch tire for cars in the light weight class. This was a seven oversize, and could not help but produce the bad reaction which followed eventually.

Early experience with super-balloons confirmed previous knowledge that merely selecting a certain oversize tire by no means gave a greatly improved ride unless low enough pressures were adopted to more than offset the increased tire size.

So far as I know, efforts thus far have not produced a super-balloon (triple oversize) that exceeds or even equals the tread life of the corresponding balloon tire.—Excerpts from paper read by B. J. Lemon before Cleveland Section, Dec. 12, 1932.

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between

Jan. 10, 1933, and Feb. 10, 1933

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (S M) Service Member; (F M) Foreign Member.

BERLINER, J. F. T. (M) chemical engineer, E. I. Du Pont de Nemours & Co., Inc., Experimental Station, Wilmington, Del.

CROWELL, ABRAHAM ALBERT (S M) design draftsman, Naval Aircraft Factory, Navy Yard, Philadelphia; (mail) 4841 North Broad Street.

FAIRALL, EARL L. (S M) design draftsman, aircraft power plants, U. S. Naval Aircraft Factory, Engineering Department, Philadelphia Navy Yard, Philadelphia; (mail) 2928 South 18th Street.

HANNA, MAURICE (A) automotive electrician, Storage Battery Supply Co., Seattle, Wash.; (mail) 2727 James Street, Bellingham. Wash.

HARRIS, LUTHER (M) maintenance of aircraft, American Airways, 122 East 42nd Street, New York City; (mail) Hixson, Texas.

HILDENBRAND, KENNETH WESSELL (A) manager, Detroit factory branch, John Warren Watson Co., Bridge Street and P. R. R., Philadelphia; (mail) 115 Willis Avenue, West, Detroit.

HORTON, CARROLL T. (M) engine assistant, Western Union Telegraph Co., 60 Hudson Street, New York City.

INATOMI, HISAO, Ordnance Lieut. Com. (F M) member, engine design, Imperial Japanese Navy, Kaigun Kokusho, Hatstudokibu, Taura, Japan; (mail) Shinkarasumaru Kamikiridoshi Sagaru, Higashi, Kyoto, Japan.

LEWIS, JOHN E (A) sales representative, Mack International Motor Truck Corp., Chicago; (mail) 4920 Ellis Avenue.

LINSE, HARRY J. (M) president, Prismatic Spark Plug Co. of America, 14 Dunham Place, Brooklyn, N. Y.

LITCHFIELD, ALLYNE C. (M) manager, materials division, U. S. Rubber Coi., 6600 East Jefferson Avenue, Detroit.

MCCULLOUGH, ARTHUR LEE (M) operations manager, Compania Nacional Cubana de Aviacion, General Machado, Provincia de Habana, Cuba.

PAXTON, HUGH M. (A) engineer, Michigan and Ohio representative, Dardelet Threadlock Corp., 120 Broadway, New York City; (mail) 424 Book Building, Detroit.

SMITH, CHARLES A., JR. (J) Daniels Street, Millis, Mass.

TAYLOR, OTIS A. (A) research test engineer, Continental Motors Corp., Detroit; (mail) 8920 North Martindale Avenue.

ZARTMAN, JOSEPH V. (A) technical engineer, Lincoln Oil Refining Co., Robinson, Ill.; (mail) 4930 College Avenue, Indianapolis.

Applications Received

The applications for membership received between Jan. 15, 1933, and Feb. 15, 1933, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

ARMSTRONG, EDWIN F., engineering supervisor, General Motors of Canada, Oshawa, Ont., Canada.

BRINTNELL, W. LEIGH, president, Mackenzie Air Service Ltd., Edmonton, Alta., Canada.

BROWN, L. T., associate professor, mechanical engineering, Iowa State College, Ames, Iowa.

DICKSON, HARRY, service manager, Regina Chevrolet Sales Ltd., Regina, Sask., Canada.

DUBONNET, ANDRE, automobile manufacturer, 114 Boulevard, Maurice-Barres, Neuilly, Paris, France.

FIPPINGER, DAVID, owner and mechanic, Reliable Motor Repair, Totowa Borough, N. J.

FLETEMEYER, RAYMOND E., president and treasurer, Stewart Motor Truck Co. Inc., Pittsburgh, Pa.

FOSTER, C. A. JR., technologist, Shell Oil Co., San Francisco, Cal.

GEORGI, CARL W., chief chemist, Enterprise Oil Co. Inc., Buffalo, N. Y.

GRANVILLE, ZANTFORD D., president and chief engineer, Granville Bros. Aircraft Inc., Springfield, Mass.

HEDGES, H. O., president, Hedges Motor Co., Seattle, Wash.

IMPERIAL JAPANESE NAVY, New York City.

JACOBUS, ALVAH R., service manager, Cadillac Motor Car Co., Newark, N. J.

LORENZ, F. A. JR., general manager, Industrial Division, American Steel Foundries, Chicago, Ill.

NELSON, GEORGE W., Lieutenant, U. S. Coast Guard, Station USS George E. Badger CG, New London, Conn.

PAQUIN, NORMAN, engineer, Aluminum Industries Inc., Cincinnati, Ohio.

PRIESS, HAROLD EDWIN, trim and glass inspector, Fisher St. Louis Body Co., St. Louis, Mo.

RINGER, HENRY WINFIELD, chief engineer, Civic Utilities Corp., New York City.

ROTHERMUND, WERNER R., resident patent attorney, Aeromarine Plane & Motor Co., Keyport, N. J.

RUSSELL, THOMAS M., engineer in charge mechanical testing, Russell Manufacturing Co., Middletown, Conn.

THOMAS, RUBERT MATHIAS, secretary and general manager, The Perfect Circle Co. Ltd., W. Toronto, Ont., Canada.

TURNER, LOUIS E., 1730 Broadway, New York City.

WAIT, FRANK D., vice-president, The Autocar Sales and Service Co. Inc., New York City.

WOOD, CORLAN E., service manager and engineer, Blood Bros. Machine Co., Allegan, Mich.

ZIMMERMANN, FRANK A., president, National Governor Corp., Chicago, Ill.

Notes and Reviews

THESE items, which are prepared by the Research Department, give brief descriptions of technical books and articles on automotive subjects. As a rule no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.

AIRCRAFT

Flying Boats—The Form and Dimensions of Their Hull

By G. S. Baker. Published in The National Physical Laboratory Collected Researches, Vol. XXIII, 1932, London, p. 3. [A-1]

The development of speed in transit in various cases and the strategic and commercial value of airplane carriers are considered. The relative advantages and disadvantages of flying boats and land machines so far as Great Britain is concerned are stated.

The dynamic requirements of the hull are given, and are considered in detail under the several headings of diving at low speed, seaworthiness and ability to change trim at high speeds.

Detailed consideration is given to the subject of main dimensions of hull in general, loading up a hull of varying beam (on propulsion and transverse stability), number and position of steps, longitudinal contour of ends, and requirements of wing floats.

A comparison is made between results obtained in full scale tests and similar results deduced from tank experiments.

A short account of work done in connection with stresses on the hull of a float when moving in waves on the water, and formulas for calculating the resulting bending moments and maximum impact blows are given, together with approximate figures for maximum local stresses obtained from tests on a machine in smooth water.

Aside from Mr. Baker's article the volume is concerned with ships.

Wing Construction

By H. J. Stieger. Published in *The Journal of the Royal Aeronautical Society*, October, 1932, p. 789. [A-1]

Weight is the key to everything that matters in aircraft construction, the author contends, adding that it is of paramount importance to performance, comfort and safety.

The weight figures for aircraft are classified into three groups:

(a) Weights over which the designer has no influence, namely, engines and accessories, airscrews, instruments, wheels, and brakes, representing about 35 per cent of the empty weight of a normal commercial machine.

(b) Weights over which the designer has a limited influence, namely, fuel tanks and pipes, cowlings, engine controls, cabin equipment, upholstery and windows, and heating, representing about 20 per cent of the empty weight.

(c) Weights within the designer's influence, namely, wings, fuselage structure, tail unit, chassis, and flying controls, representing about 45 per cent of the empty weight.

The wing construction, said to represent about 50 per cent of the weight items which are directly under the designer's influence, is considered in detail in this paper from the standpoint of saving weight by careful layout in view of the aerodynamic loads and an efficient structure to transmit these loads.

Some Notes on the Design of Aeroplane Control Surfaces and Control Systems

By Walter F. Dowsett. Published in *The Journal of The Royal Aeronautical Society*, November, 1932, p. 963. [A-1]

This paper is concerned with the design of the essential control system of the airplane, comprising the elevators, ailerons and rudder. The author considers the factors influencing the aerodynamic design of the control surfaces and those influencing the structural design of the complete system, under two distinct heads to facilitate the interpretation of the conclusions.

The Pilcher Memorial Prize was awarded the author for this contribution.

(Concluded on next left-hand page)

NOTES AND REVIEWS

Concluded

ENGINES

Areo-Engine Development

By R. V. Cautley and H. S. Mazet. Published in *Aircraft Engineering*, September, 1932, p. 221. [E-1]

This article constitutes a review of the basic trends in aircraft engine design during the past thirty years presented to the readers of *Aircraft Engineering* as representative of the American point of view.

Areo Engine Accessories

By W. L. Taylor. Published in *The Journal of the Royal Aeronautical Society*, October, 1932, p. 828. [E-1]

Since the Armistice the gradual development of the various types of aircraft engines, together with the abandonment of windmill drive accessories, has necessitated an increase in the number of auxiliaries incorporated in the engine structure, the author points out, and compliments engine designers for the ingenuity and compact arrangement of the auxiliary drives and housings on present-day aircraft engines.

The auxiliary drives for valve operation, dual magnetos, oil pressure and scavenge pumps, water and gasoline pumps, supercharger, turning, starting and gun gears, are usually grouped in a housing or housings at the rear of the engine, except that on the radial air-cooled engine the valve gear is arranged at the front and the water pump is unnecessary. The more recent accessories are reviewed in this article, including the various superchargers in use, automatic boost control, automatic mixture control, flame traps, magnetos, spark plugs, starters and silencers.

A Study of Piston Temperatures and Their Relation to Piston Design

By H. Wright Baker. Published in the *Journal of the Institution of Automobile Engineers*, November, 1932, p. 25. [E-1]

A large number of pistons, 3½ in. diameter and of different designs, were tested by the "cooling curve" method under full-load conditions at 1640 r.p.m. Temperatures were taken at five points on the crown and two points on the skirt thrust face, and corresponding cylinder-barrel temperatures were measured at eight points. The apparatus, test-routine and method of deducing conclusions are described.

Marine Engines

Published in *The Automobile Engineer*, November, 1932, p. 543. [E-1]

In comparison with last year's show, the marine section of Olympia was considerably less this year. A review of the more interesting exhibits is given, noting especially a decline in the popularity of the outboard type of power unit.

Classification des Doctrines Constructives et des Alliages en Matière de Pistons en Métaux Légers et Ultra-Légers

By R. De Fleury. Published in *Journal de la Société des Ingénieurs de l'Automobile*, December, 1932, p. 1979. [E-1]

A simple, rigid design in a high-silicon alloy is, in the author's opinion, the type of aluminum piston best suited to both automotive and large size Diesel engines. He comes to this conclusion after analyzing the defects in service of aluminum pistons and the theories, often contradictory, of design and material affecting them that have developed since their first appearance on a stationary engine in 1900.

Other salient points that he emphasizes in his conclusions are that the tendency in heat-treating aluminum alloys for pistons is simply to anneal them at a temperature higher than that to be anticipated in service and that exploiters of aluminum alloys for pistons dwell on the hardness of the material, passing over in silence the more important properties of heat conductivity and thermal expansion.

Les Applications des Moteurs Diesel à la Traction sur Voie Ferrée

By G. Delanghe. Published in *Le Génie Civil*, Dec. 31, 1932, p. 645. [E-1]

The next step in the use of Diesel engines for locomotives, according to the author, is the further development of means by which the Diesel can give, in direct drive, the type of power curve characteristic of the steam engine. Thus the one reproach lodged against the Diesel engine, that it entails the use of a heavy, expensive and sometimes inefficient transmission, can be avoided. The author selects supercharging as the most effective and suitable means for this end.

The article compares Diesel engines with steam and electric power-plants, to the decided advantage of the first named, and describes the means by which the Diesel engine has been adapted to locomotive service.

Leadership and Labor Are The Twin Problems of Industry

By K. T. Keller

"Labor, from the viewpoint of the employer, must be considered as a human equation with all of its responsibilities."

Courtesy Detroit Free Press

K. T. Keller
Vice-President in charge of Manufacturing, Chrysler Corp.

LEADERSHIP in the automobile industry, fortunately, is still in the hands of men who grew up with it. Most of them have a solid background of personal experience in operating many of the processes employed. Some brought to the automobile industry in its early days, a journeyman's experience and a valuable, personally-acquired knowledge of what a workman thinks of his job and his superiors.

Will our industry continue to draw its leadership from within?

It will if we continue to develop men motivated by the same earnestness displayed in perfecting processes.

STARTING in the shop as apprentice before he came of age, Kauffman T. Keller has had practical experience from bottom to top. Probably no man in the automotive industry is so well qualified to discuss the human problems arising in production. He has been successful. And the number of his friends has multiplied as his success has increased—truly an achievement to be proud of.

He was born a little over 47 years ago in the little town of Mt. Joy, Pa., situated in the Pennsylvania Dutch country between Lancaster and Harrisburg. He completed a high school education before going to work for the Westinghouse Machine Co. as apprentice to the assistant foreman.

He stayed four years there before going to the now defunct Steel Products Co. as general inspector on Chalmers and Hudson axles. From then on his movement upward was steady. Within the next few years we find him as general foreman of the old Metzger Motor Car Co., chief inspector for Maxwell at its Tarrytown plant, and then from 1912-1916 general superintendent of Northway Motors.

After a year with Cole Motor Co., he made his first connection with General Motors as general master mechanic at Buick. Later he became manufacturing manager of Chevrolet and finally, as vice-president and general manager, was put in charge of the Corporation's entire Canadian operations.

Following two successful years across the border, he was claimed by the fast-growing Chrysler organization as vice-president in charge of manufacturing. This position he has held ever since 1927, although as president of Dodge Bros. Corp. his industrial power and influence have continued to increase apace since that time.

In this article he compresses into a few pages, filled with terse, crisp comment, the experience of more than 25 years in automotive manufacturing, a good share of which has been spent in actually handling problems of human relationships in industry.

The many technical decisions to be made by management today, plus the complex problems arising from competition—even more intense in these periods of depression—are liable to crowd out of a busy executive's mind and time the very important human side of business.

Just as surely as policies are developed they have to be carried out to become effective.

Every new design has to be tooled and produced.

Rapid and radical changes require improved technique and swift execution to become effective and to maintain quality production.

Business has become not only seasonable but sensitive to mass opinions generated by advertising and even by organized propaganda.

The producing side of the industry is contacting with so many phases of the business that we are liable to have our attention drawn from the important problem of developing and directing the working organization.

In defining working organization, I prefer to start at the employment office and go through to the factory manager.

To get a general perspective of the importance of the working organization to the total physical picture I wish to give you some figures. In compiling them I have used our own corporation records because they are accurate and easily accessible.

The Chrysler Corporation is about 90 per cent located in Detroit. Our working force is important, therefore, not only to our business but to the general welfare of the community as well.

We have 14 distinct and separate factories. They contain 12,876,478 sq. ft. of floor space, mostly in modern and excellently constructed buildings.

We have 7 operating managers—9 factory managers—88 general superintendents—340 general foremen—654 foremen and 26,573 working employees. These figures refer to the manufacturing organization only.

Industry and its employees understand the importance of operating with a compact organization and an even distribution of work.

I thoroughly believe that many of our Detroit automotive industries today are doing more to level hours between their employees and to relieve unemployment than is being displayed in the other employing businesses of the city.

The distributing of work among employees has to recognize two important elements, both of which have an important place in determining the number of hours per week or month and the number of men to be worked: (1) the demand for the products produced and (2) the "Share the Work" movement.

An intelligent handling of program, production and employment in times like these is essential.

Care must be exercised not to over-expand a working force for what is known in advance to be a very short period of stressed production. I prefer to look at individual employment from the standpoint of the earning hours our employees enjoyed over a period of one year.

No one can successfully deny that our production is seasonal, and as such is bound to experience peak working forces

and subsequent lay-offs. Varying the hours worked plus intelligent production control should cut down the peaks and reduce the extent of the lay-offs.

We production men should contribute what we can to level our organizations to our average requirements and employ the number of hours consistent with existing conditions.

A suggestion on this point is to canvass the ability of the people now on the payroll of any individual company. I will be very much surprised if it is not found that at times a man is being laid off from the production department who has had good experience at tool making or as a millwright, while at the same time men are being hired at the employment department to fill such jobs.

Further, isn't it advisable to train known good employees so they need not be considered single operation men?

In many departments, the nature of the work is such that it permits the foreman to change men frequently to different jobs.

This method has many advantages. It enables the foreman to study the adaptability and mechanical ability of his men. He is protected during temporary absences of his men, because he has trained other men to operate the jobs. The men are placed where they fit best and hence are more satisfied.

If a skilled employee quits, the foreman transfers the man next in line to the job and hires an inexperienced man for a job requiring little skill. The promotion of a man to a better job with a higher base rate encourages others in the department.

In promoting within the department rather than filling the more important jobs with new employees, the foreman can exercise better control and judgment in placing the men, because he is working with men whom he knows.

From the viewpoint of this discussion, the chief benefit of rotating the men is to enable the foreman by means of actual contact and study to analyze his men according to the definite results shown on the different jobs and to place them properly. I can say from experience that the results which can be accomplished along these lines are surprising.

Man Power Control

I wish to refer again to man-power control. It is my firm belief that too often, in attempting to cure difficulties, bad work is produced and production reduced by filling up a department with too many untrained men, when the trouble really lies with the leadership of the men and the lack of adequate mechanical preparation for the production undertaken.

Man power control is particularly important in piece work production.

Realizing that criticism is unfair without suggestions I would like to suggest to every production man a few simple rules based on experiences:

(1) You must have a policy. It need not be a lengthy written procedure; the shorter the description the better. But it must be a policy that you believe in yourself. It must recognize the desire of the workman to present his complaints, and it must put the burden of responsibility of handling the working force on the foreman whom you employ to look after it.

This policy must be in keeping with the times. It must be changed as conditions require change and perfected as the education of your supervision permits. The chief executive will have to keep in touch with it almost continuously.

It cannot be handled by a set of rules, but as with our national laws, wise interpretations and decisions must form the final meaning of the policy. The executive will have to live close to his job and close to the times.

(2) Education of the factory supervising force is needed. A good school of what is commonly called foreman's training is the best vehicle for educating a force. I have never seen a prepared course that I felt fitted our situation. If you are truly interested in carrying on a real job of foreman

Kellerisms

The automobile industry will continue to draw its leadership from within if it continues to develop men with the same earnestness displayed in perfecting processes.

* * *

Just as sure as policies are developed, they have to be carried out to become effective.

* * *

Care must be exercised not to overexpand a working force for what is known in advance to be a very short period of stressed production.

* * *

The chief benefit of rotating men from one job to another is to enable the foreman to analyze his men . . . and to place them properly.

* * *

Loyal foremen develop loyal shop workmen.

* * *

More interest is being shown in the Chrysler foreman training course at the present time than at any period since it started in 1928.

* * *

When any one undertakes to manage a factory, he must accept the responsibility of considering labor as a human equation. Every production man, therefore, must study that responsibility and apply himself to it. He must make it a part of his life and job. If he understands his shop and works intelligently with it he will find his job a pleasure.

education, study the subject yourself, your problems and the courses available, and then lay out your own course.

We started with the foremen themselves, having them list what they considered the ten most important duties of a foreman. We uncovered such a difference of opinion that we had 160 duties listed by 70 foremen.

Our next step was to get these same foremen, with, of course, executive collaboration, to choose the 10 most important functions upon which they could agree. We then proceeded to study them one by one. Foremen's courses now are held regularly on company time. Meetings are frequent but of short duration and the classes are held in small groups so as not to have too many men away from the work at one time.

Some may not agree with our method, but it did create a genuine interest in study and it does make the study a real part of the job.

The Chrysler course has been in continuous operation for 5 years. Some outstanding features which distinguish it from other courses are:

A. All material furnished the foreman is subject to constant revision in order to reflect the policies and procedures of the Corporation. Some lessons have been revised as many as six times since the course started in January, 1928.

B. One individual conducts all conferences. This results in uniformity of presentation of policies. The knowledge and skill thus gained are utilized with the new groups.

C. All material is prepared for distribution to minor production executives. Thus material is strictly adapted to our own particular needs.

D. Special short courses as needed are presented on such subjects as safety, wage payment plans, budget control, time study, etc.

There have been 37 groups of an average of 18 per group, making a total of 666 in regular scheduled conferences, besides several hundred in special short courses. Some of the best results have been achieved during the depression period. Industrial training during periods of depression has proved very profitable. There is always a waiting list of those desiring to take the course.

The course has emphasized and developed willing cooperation.

It has proved to be the best method of getting new policies and procedure accurately to the foremen. Letters and written instructions, too, often are interpreted differently. Discussions clear up any misunderstandings.

Constant Revision Needed

Constant, painstaking revision of the course has developed a manual much prized by the foremen. They register quite a protest if asked to turn manuals in.

Some comments from the recent letters from foremen might well be quoted. I was much impressed, for instance, with Foreman Smith's comment that after finishing the course he felt that previously he must have been asleep on the job. Coming from one of the best foremen in the Corporation, that statement is full of significance.

Voluntary labor turnover among our foremen has been exceedingly low. This is proof of their understanding of the aims of, and loyalty to, the management. Loyal foremen develop loyal workmen.

Foremen's interest in the course seems to have been gradually growing. More interest is being shown at the present time than at any period since the course started. This is demonstrated by frequent requests for a continuation course and by many taking night school and University Extension Courses to supplement our course of training. Our course is still growing, our text is gradually enlarging. Some of our men have been going to school for 4 years and as long as we have foremen we expect to find something of importance to teach them about this important work.

Our text is not for sale. Nor do we give it out. The chances are it would not fit other conditions. The principles of it as outlined above I believe good and recommend them.

Watch for Trouble

(3) Set up your system of wage payment, whatever the plan used, so that the foreman knows daily whether he has the right number of men in his department—and more important—that they are earning the wages you in your policy expect them to earn.

If you do not do the first you will not do the second. Keep track of the working out of the wage policy yourself and go to the seat of the trouble when results are not what you expect them to be—and go quickly.

(4) Develop a willingness to consider the frailties of the workman and cooperate with your organization in welfare work, safety, group insurance for sickness and death if possible.

We have employee's insurance covering both sickness and death. It has been in operation 43 months. During this period we have had 473 deaths and 119 permanent disability cases.

Still further covering welfare cases that do not come under the cooperative insurance mentioned above, there has been excellent and meritorious assistance given.

(5) If you want a well directed and competent crew of workmen, start in the employment department. Now is the time to select your men. A likely applicant should be carefully investigated and checked. Build yourself a sound organization capable of becoming proficient in the work you are doing. If you are to have a good crew it is necessary to choose humans of physical and mental fitness to meet your type of organization.

Labor, from the viewpoint of the employer must be considered as a human equation with all its attending responsibilities.

When any one undertakes to manage a factory he must accept those responsibilities. Every production man, therefore, must study them and apply himself to them. He must make them a part of his life and job. If he understands his shop and works intelligently with it he will find his job a pleasure.

"WE have been through a frightful period; but it had to come some time and it's almost over.

"Even in the building of a great cathedral, the edifice must be hideous before it becomes beautiful. Out of the chaos of great piles of dirt and stone—marred by unsightly scaffolding—it gradually shapes itself into a house of worship that enthralls thousands by its beauty.

"So it must be with us. Step by step we must win our way back."—Roy Faulkner (from a talk made at the 1933 Annual Dinner).

Chronicle *and* Comment

By
Norman G. Shidle

LEGISLATIVE forays against motor vehicles, which continue despite efforts at cooperative action between rails and the motor industry, find automotive engineers in the front line trenches. Somebody else is actually hurling the grenades of fact with which it is hoped to blast the forces of restriction and obstruction—and that is as it should be. The engineer, nevertheless, is being called on as never before to furnish more and more potent ammunition.

What's more he is doing a better job of ammunition-furnishing all the time. Prominent design and operating engineers in many companies are taking a really active part in the campaign for sanity which the industry is waging against strong forces of unreason in 1933 legislative sessions.

No longer is the alert engineer content to supply information when it is asked for. He sees his own job and future threatened. He is studying for himself the relation of design and operating problems to the economic transport picture. From his background position he is laying out campaigns as well as supplying ammunition.

Other groups will always be better equipped to make the attack, but the part played by the engineer increases constantly.

EVERY once in a while the fire of argument started at some Society meeting session goes on gaining momentum over wider and wider areas, instead of flaring brightly for the period of the session itself and then dying off or smouldering quietly until another chance for open discussion presents itself.

Nearly every member can name at least one such session in his own experience. The old timers can recall plenty.

That production session which featured ex-Councilor J. E. Padgett's paper about principles of low cost tooling is turning out to be the latest example of just such a gathering. Despite the disarming title of his paper, what Mr. Padgett really did was to tell the machine tools fellows that they ought to eliminate all the frills, refrain from sending a lot of service engineers into customer's plants, stop worrying about beauty and suchlike factors and then *cut the price.*

And nobody dropped dead with surprise—least of all Mr. Padgett—when, at the session, several machine tool men present arose in pointed disagreement with some of the ideas propounded by the Spicer vice-president. In fact, we have more than a suspicion that some of Mr. Padgett's remarks were very carefully phrased in the hope of drawing some really strong fire from tool builders and thus getting an important problem right on top of the table for frank discussion.

Well, some such discussion did take place at the meeting as recorded on page 29 of the S.A.E. JOURNAL for February. But that was only a starter. We've been getting confidential letters from machine tool makers who, naturally in some instances, are not eager to appear in open argument; we've been approached in informal conversation about the same subject and we've been receiving some discussion for possible publication in the JOURNAL. We'd like more of the latter. And we'll take it upon ourselves to assure discussers that Mr. Padgett will welcome a brisk continuance of the argument just as much as this editor who is seeking interesting copy.

SOME JOURNAL writers recently have indicated that they profess surprise when they find an automotive engineer capable of repairing his own automobile. They have suggested, in other words, that engineers have difficulty in gaining proficiency even in a hobby so closely allied to their own work. Yet we have frequently been astounded at the versatility and avocational proficiency of many technical men. A story of their hobbies would be as interesting as any pages of "Believe It or Not" and might cast a new light on the psychological wells from which spring the emotions which motivate engineering thought and action.

All of which lucubration has come about because of a simple request which came to us yesterday from a Member of the Society. He asked for a good profile picture of Coker F. Clarkson, beloved general manager of the Society from its beginning until the time of his death in 1930. This member is engaged in sculpturing a bust of Mr. Clarkson. He needs the profile picture for use in this labor of love. We couldn't supply it. Can you?

Your aid in the search for this picture will be deeply appreciated both by this sculptor member and by all other members of the Society who later may enjoy the fruits of his labor.

Galloway

Hold of Railroads on *Legislatures* Cramps Truck Design and Use

By T. R. Dahl
Vice President, The White Co.

OUT of every dollar the public spends, 25¢, on the average, is spent to pay the transportation part ot the cost of the article purchased. The public's pocketbook is, therefore, directly interested in motor truck transportation.

The effect of motor truck transportation in reducing the price of commodities is aptly illustrated by the price of milk in the City of Chicago. Four years ago the cost of transporting milk within 100 miles of Chicago by rail was 36¢ per 100 lb. Motor trucks entered this short haul field and reduced the rate to 24¢ per 100 lb. The development of large pneumatic tires and State legislation authorizing the operation of six-wheel trucks, permitted the carrying of greater pay loads resulting in motor trucks further reducing the rate to 14¢ per 100 lb.

A further reduction from 14¢ to 12¢ per 100 lb. was made possible by the perfection of light weight stainless steel and aluminum bodies, permitting the hauling of greater pay loads without increasing gross weight.

Accordingly, within four years the cost of transporting milk within 100 miles of Chicago was reduced by motor trucks from 36¢ to 12¢ per 100 lb. The direct public benefit in this tremendous reduction in the transportation cost of milk is reflected in the reduction in the price of milk in Chicago from 13¢ to 9¢ a quart.

In most of the States today highway transportation is being treated as a political problem because of misinformation or ignorance of available facts. It is of the greatest importance to the public that the facts concerning highway transportation be clearly understood in order to prevent the enactment of laws unreasonably restricting and unfairly taxing motor transport at the direct expense of the public.

"The statement that trucks use the highways without charge is insulting to the intelligence of any truck operator."

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"The motor industry has done more for the railroads of the Country than any other industry."

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"The transportation problem in this Country will never be decided until the principal interest involved, namely, that of the public, is given the consideration it deserves."

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"There can be no progress in discriminating legislation."

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Lazarnick

The one most important fact in considering motor truck regulation, taxation and competition is the large private ownership and operation of these vehicles. The Bureau of Public Roads of the United States Department of Agriculture has determined by actual traffic counts on the highways of about one-third of the States that 85.8 per cent of all motor trucks are privately owned and operated. This is practically nine-tenths of the three and one-quarter million motor trucks in this country today. In round numbers it is 2,800,000 trucks.

The ownership and use of these trucks must be understood in order to deal intelligently with this problem. These 2,800,000 motor trucks are not operated for hire. They are used in the private business of the individual owning them, and are operated on our highways in the same manner that passenger cars are operated, carrying the owner's property instead of his person. It seems to me an astounding fact that with three and one-quarter million motor trucks in the country 2,200,000 people own but one truck each. This fact is only understandable when it is realized that the motor truck replaced the horse and wagon.

The traffic surveys referred to establish that the greatest volume of truck traffic is between 40 and 60 miles a day. Of the truck mileage of the country 68.8 per cent is less than 120 miles per day. Can any one with these facts before him entertain any idea that motor truck transportation is a national transportation system comparable, for instance, with the railroads, where 85 per cent of the railroad mileage of the country is owned by fifteen railroad systems?

You have heard many unsupported statements that motor trucks are damaging the public highways. For over ten years the Bureau of Public Roads of the United States Department of Agriculture has been making actual physical tests of the effect of trucks on highways. The Chief of the Bureau of Public Roads clearly established in his testimony before the Interstate Commerce Commission that the great enemies of highways are frost, moisture, and sub-soil conditions, and based on that premise he testified that in order to carry an ordinary passenger car, or a light farm truck, it is necessary to construct a 7-6-7 highway surface. This means a surface slab 7 in. thick at the sides and 6 in. thick at the center. If surfaces were constructed of less thickness than that designated they would warp and the frost heave would destroy them. Mr. MacDonald, thereupon, reached this conclusion:

"So we have a certain minimum thickness of road that it is necessary to build if there were nothing heavier than the ordinary passenger cars and farm trucks to use the road, and the whole question of the heavier buses and heavier trucks, therefore, begins with a certain minimum thickness of road which is necessary, regardless of whether they existed or not."

The railroads are continually appealing to the public for "equality of opportunity" on the ground that motor trucks are subsidized by the use of a free highway, whereas they are compelled to own and maintain their own roadbeds.

Disregarding for the moment the subsidizing of the railroads themselves through stupendous land grants and the fact that the Reconstruction Finance Corporation loaned more money to the railroads in 1932 than the railroads paid in all taxes, what are the facts?

The statement that trucks use the highways without charge is insulting to the intelligence of any truck operator.

Proceeding from the premise established by Federal Government Department tests that it is necessary to construct a 7-6-7 surface to carry passenger cars, and that such a surface will carry without damage up to a 5-ton truck, the tests show that in order to safely carry a large number of 5-ton trucks, highway surfaces should be increased ½ in. in thickness. If, therefore, trucks pay for this ½ in. increase in thickness they pay the entire additional cost of highways which they use.

This only applies to increasing the thickness of the surface, as rights of way, surveying and grading must all be done regardless of how thick a surface is to be built.

A ½ in. increase in thickness increases the cost of the surface 7.7 per cent. Today a 7-6-7 surface costs about $20,000 a mile to build and a 7.7 per cent increase in cost amounts to but $1,550 a mile. Now, the question is simply this:

Do trucks pay $1,550 a mile more in special taxes than passenger cars pay? If they do they pay their full share of the cost of the highways they use.

The facts conclusively answer yes.

First: Trucks constitute but 12 per cent of the vehicles using the highways, but pay 29 per cent of the total special taxes paid by all vehicles, which in 1932 amounted to over $290,000,000.

Second: Experts confirm this conclusion. Mr. MacDonald testified, based on these facts, as follows:

"In my judgment, the heavier trucks and buses by the higher tax which they are paying, and particularly through the collection of gasoline taxes, are fully meeting all excess costs of construction, due to the increased thickness that is made necessary by these heavier loads."

Third: Governmental Department surveys prove this contention:

In the Pennsylvania road survey made by the Federal Government in which the taxes to be paid by each type of vehicle, in order to carry its full share of the cost of the highways which it uses, were broken down, the figures established that motor trucks in Pennsylvania were paying their full share of the entire cost of the construction and maintenance of the Pennsylvania State Highway System. Motor trucks alone in 1932 paid to the State of Pennsylvania $24,458,000.

The motor truck is continually maligned as a dangerous vehicle on our highways. What are the facts? The National Safety Council is nationally accepted as an authority on motor vehicle accidents. In its report made in April, 1932, it said:

"It is the truck driver who is causing fewer accidents. During the last four and one-half years the number of commercial vehicles involved in accident fatalities *decreased* 31 per cent. During the same period, privately operated passenger cars involved in accident fatalities *increased* 59 per cent."

Can you conceive of a more conclusive answer to that allegation?

Alleged competition of motor trucks is accused of ruining the railroads and putting men out of work. What are the facts? First, as to employment. Do you know that a five-man freight train crew can handle freight that it would require 1500 5-ton trucks with drivers and helpers to transport? One out of every ten persons gainfully employed in this country is employed in the motor vehicle business. There are one and one-half million truck drivers alone in the United States, without considering helpers and service employees, while the 1930 census is authority for the statement that there are only 1,275,653 railroad employees in the country.

Misinformation Is Common

Much misinformation is being given to the public on the question of motor truck competition with the railroads. The facts have established that nine-tenths of our trucks, being privately owned and operated, are not competing with our railroads, as they are engaged in the owner's private business. Consequently, all claims of competition must be limited to one-tenth of the trucks.

Trucks are alleged to take the cream of the traffic—the high tariff less than carload lot freight. Disregarding the repeated allegations of the railroads themselves in the past that this traffic is not remunerative because of great terminal costs, consider the reports of the railroads of the country to the Interstate Commerce Commission for 1930, in which their tonnage figures prove that only 2½ per cent of the railroad's freight is L.C.L. freight. According to the American Railway Association (report of January 15, 1931) 26 per cent of the railroad freight cars were used to carry 2½ per cent of its tonnage. What other business do you know of that could survive under such operating conditions? It is therefore a provable fact that what the railroads complain of is that one-tenth of the motor trucks compete for part of 2½ per cent of its business which it handles by loading its 50 to 80-ton freight cars with an average load of 2.6 tons.

Taking the year 1929, you will find that the railroads carried four hundred and fifty billion ton miles as against fifteen billion ton miles for trucks. Comparing these ton mileage figures, trucks carried but 3.7 per cent of the total ton mileage. Even the Great Lakes, which carried approximately one hundred billion ton miles, carried 600 per cent more ton miles of freight than motor trucks carried. The important fact apparent is the tremendously small percentage of ton miles of freight that the motor truck competes for with the railroads. The Interstate Commerce Commission itself says that during the peak traffic year of 1929 only 4.2 per cent of the inland freight of the country was carried by inter-city motor trucks.

The answer to the present falling off of railroad earnings lies in the reduction in volume of industrial production.

Motor trucks alone paid as much in special taxes as the railroads paid in all taxes other than Federal income taxes which, of course, motor trucks pay as well as railroads when they have any net income. The Government last year collected sixteen times as much in taxes on a ton of freight hauled one mile by motor truck as it collected on a ton mile of rail freight.

There is no public demand for motor truck business regulation and taxation. The Interstate Commerce Commission in its last report to Congress says: "It is also a significant circumstance that there is substantially no demand for public regulation of charges of motor trucks to protect shippers against exorbitant or discriminatory charges. The demand has been chiefly from the railroads."

The transportation problem in this country will never be decided until the principal interest involved, namely, that of the public, is given the consideration that it deserves.

There can be no progress in discriminatory legislation.

The Remedy

By H. C. Dickinson

President, Society of Automotive Engineers

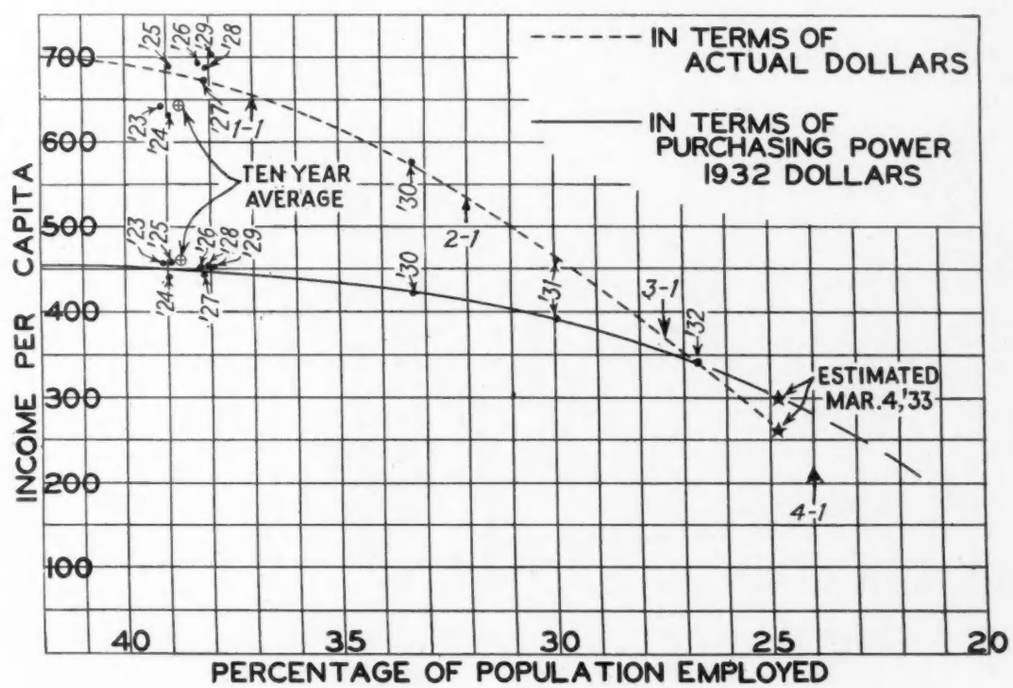
IN the February number of the S.A.E. JOURNAL Dr. Dickinson pointed out in general how and why inflations and depressions occur and how they may be controlled.

Here he shows in detail how a simple and familiar business transaction undertaken by the United States Government can quickly and certainly restore national prosperity.

RESTORATION of prosperity requires only an economic set-up similar to that which restored prosperity in the United States in 1914-15. Then we put people to work making goods to send abroad. We used credit based on the prospects of European nations being able to pay in the future, to supply a market for goods abroad. Now we have a market for at least 20 billion dollars worth of goods at home, and we require only credits based on the *certainty of this market* and the added certainty that capital values in the United States will rise by more than 100 billion in the next two years, *if people are put back to work.*

The accompanying plot shows the surprisingly close relationship between men at work and net national income. As employment has decreased in the past three years there has been a steady fall in net national income, or in average net income per individual (as here shown). This relationship is plotted on the upper curve in terms of dollars, and on the lower one in terms of 1932 purchasing power. It is seen that the net income has fallen more and more rapidly as unemployment has increased. At the point marked 1-1, when about 2 million were unemployed, the fall in net income was *equal to* the saving in wages through reduced staff. At the point marked 2-1, when about 7 million were out of work, the loss of income was equal to *twice* the saving in the wage bill. At the point marked 3-1, when about 12 million were unemployed, the loss in net income was *three times* the total wages of the unemployed. At the present time, March, 1933, the factor is about 3½ to 1. This means that when a man is discharged there is a loss in net national income, expressed in dollars, about 3½ times the saving through this cut in wages.

If this analysis is applied to the lower curve expressing income in terms of cost of living, it is found that the net income decreases two dollars for each dollar saved by discharging personnel. The 3½ to 1 factor is based on the



assumption that prices in the United States are fixed by *internal conditions only;* the second assumes that United States prices are controlled *entirely by world prices.* Obviously, the truth lies between these two limits, and it is a certainty that the loss of net national income through decreasing employment is not far from *three times* the wages of those displaced. The same conclusion has been arrived at by several independent analyses.

A Vicious Circle

It is clear then that this process of progressive unemployment constitutes a vicious circle. Discharge of personnel and the accompanying reduced payrolls and reduced will-to-buy result in decreased net income far in excess of the savings in wages. The reduced income in turn makes necessary further reduction in personnel. It is equally clear that if this process is reversed, recovery also will be cumulative in the same manner. To bring about recovery, therefore, it is only necessary to reverse the present trend; to start either large scale purchasing or large scale reemployment, which amounts to the same thing.

There is one normal business process whereby the United States Government can accomplish this result in the course of two or three years.

The first step is to establish a *recovery fund* to be received and expended at the rate of about one-half to one billion dollars a month. The total loan will amount to from three to six billion dollars.

The second step is to expend this fund at the above rate as effectively as possible to retain and restore employment at normal rates of pay, thus increasing both confidence and buying power. The most prompt and effective step in this process is to stop further unemployment, followed by measures to promote reemployment.

The first move should be to balance public budgets, without further reductions in normal expenditures. The federal budget can be balanced immediately; state and local budgets promptly through loans from the *recovery fund,* to be repaid as provided below. Budget balancing alone will be a long step toward recovery, as it will not only restore general confidence but will remove the threat of further unemployment among public servants, and among those who know that incomes depend upon purchases by public agencies or by public servants from their pay. The *will-to-buy* of more than 20 million people would be restored in large measure by this move alone.

Reemployment on useful public works and extension of social or public benefits should be given careful attention, as many sound proposals have been made.

A positive means of greatly increasing normal employment in the industries would be as follows: Let the Government offer to purchase a portion of the output of any and all industries, beginning with say 10% of the difference between 1928-29 and 1932 sales of each product. This should be purchased at current prices, only on condition that at least 75% of the sum paid should go to renewed employment. If this were done generally the net national income would increase by about three times the 75% spent for new employment, and an expanding market for the product would be certain at rising prices. The Government holdings could then be sold at a profit, the profit used to help retire the bonds, and the original sum could be reinvested in the same way until recovery is established. The Government might require the company to include in each sale a definite fraction of the Government holdings. The details of such a plan would be simple as compared with the financing of munition purchases in 1917.

The third step is to recover a part of the increase in net income which will result from the recovery process, in order to help maintain the *recovery fund.* A practicable, prompt and equitable means of doing this appears to be through such a device as a general and universal retail sales tax, supplemented perhaps by a tax on sales of professional services, the latter as a means of more equitable distribution. This tax should be collected monthly, beginning two or three months after the recovery fund is established, and should provide a part of the cost of maintaining the reemployment program. This tax should at least balance local, state and federal budgets and provide for normal public employment, which is as effective as any employment in promoting recovery. Such a tax, uniformly distributed, would absorb only a small part of the profit already made from the recovery, and could be used to accelerate this recovery, as a business spends part of the return in an advertising campaign to accelerate the campaign.

If loans are made to states or local units to balance their budgets and avoid further unemployment, the sales tax rate should be increased in these localities to repay the loans. Many municipalities would find it very desirable temporarily to reduce real property taxes and make up the deficit by an increased rate of sales tax. Moreover, as proposed here, the tax will be small in amount and will be distributed nearly in proportion to what each taxpayer has already realized in increased earnings.

The fourth step is to amortize the original loan amounting to not over five or six billion dollars. In the process of recovery, the sales value of securities will have risen by an amount probably much more than 100 billion dollars. A tax levied against this *increase* in value should be used to amortize the two-year loan. This would require a total assessment of perhaps 5% of the *increase* in security prices, and probably much less than that. This levy should be collected regardless of whether securities are sold or not in order that it should be applied promptly and universally.

The assessment should be made with fullest regard to the relative *increase* in value of all securities, since this increase is the profit which each security holder has realized from the recovery process. Prompt collection and more rapid recovery might be promoted by collecting this tax currently on all stock transfer and using the proceeds to maintain the recovery fund. The annual tax then would be levied only on the *rise* in price since the last sale.

The prompt retirement of these bonds from the immediate profits of the transaction is of utmost importance. A permanent increase in national indebtedness is to be avoided at all reasonable cost. Moreover there will be a demand for new capital investments after recovery has been accomplished and the repayment of the proposed bonds would make funds available for this purpose.

The foregoing seems to present a sound business procedure certain to bring about recovery. It is to be financed in a rational business manner on a "pay-as-you-go" schedule. It will leave no permanent burden of debt to cause another inflation and depression.

It is estimated that the entire process can be accomplished within two or three years, leaving us as prosperous as we were, on the average between 1920 and 1930.

Philadelphia Wins!

Hardecker Gets His Man

PHILADELPHIA has won the "Get-Your-Man" membership campaign. The Quaker City Section attained 50.8 per cent of its quota, thus retaining the place at the top which it has held almost continuously since the opening month of the drive. Indiana was second with 39.2 per cent of its quota, and Canadian third with 38.0 per cent.

John F. Hardecker, chief draftsman, U. S. Naval Aircraft Factory, Philadelphia, won first prize in the individual standing. He got his man. He got 14 of them, in fact, thereby contributing largely to the Philadelphia Section total of 37, as well as gaining highest honors for himself.

R. N. Du Bois, chief experimental engineer of Continental Aircraft, Detroit, and L. M. Porter, automotive research engineer of Vacuum Oil, Paulsboro, N. J., tied for second place, thereby occupying second and third places. However, each will be awarded second prize in the individual awards. H. M. Jacklin of Purdue University, and C. C. Mathis, district service manager of the White Co., in Pittsburgh, who originally tied for third place, will be considered as in the fourth place, and both will receive the award for this position.

The "Get-Your-Man" campaign was started on Feb. 1, 1932, and ended July 31, 1932. Announcement of final results was impossible, of course, until the processes of qualifying applicants were completed.

Started with high enthusiasm, this campaign to bring new members to the Society was carried through to its finish with energy and power by scores of individual workers and by practically every Section.

The stimulation of the campaign has been definitely evident in the number and quality of applicants for membership which the Society has continued to receive, despite the closing of the competitive phase of the effort many months ago.

Special honorable mention is awarded to the following men for the fruitfulness of their individual efforts during the campaign: George B. Allen, A. Gelpke, F. K. Glynn, John G. Holmstrom, C. H. Jacobsen, R. N. Janeway, L. R. Joslin, P. J. Kent, B. J. Lemon, Reese Lloyd, L. V. Newton, George O. Pooley, C. C. Stewart, R. R. Teetor and O. M. Thornton.

The following members, who have procured the largest number of new members in their particular Sections, will be given the Individual Section Award: Baltimore, George O. Pooley; Buffalo, R. F. Hall and W. A. Riehl; Canadian, R. H. Combs; Chicago, L. V. Newton; Cleveland, E. W. Stock; Dayton, George W. Winter; Detroit, R. N. Du Bois; Indiana, H. M. Jacklin; Kansas City, R. F. Hardin, Hugh C. Garrett and C. J. Stuck; Metropolitan, F. K. Glynn and L. R. Joslin; Milwaukee, C. E. Frudden and Fred W. Stein; New England, M. S. Huckle; Northwest, Reese Lloyd; Northern California, W. E. Beall and R. H. Stalkner; Philadelphia, John F. Hardecker; Pittsburgh, C. C. Mathis; St. Louis, G. C. Stevens and G. M. Bicknell; Southern California, C. H. Jacobsen; Syracuse, J. A. Murdie and M. P. Whitney; Washington, C. S. Bruce, Vern G. Rollin, R. S. Barnaby, W. F. Beasley and C. S. Fliedner; Wichita, C. A. Burnham and A. S. Swenson.

John F. Hardecker brought more new members into the Society during the Get-Your-Man Campaign than any other contestant. He won first prize in the individual standing.

Behind the Scenes With

Extreme-Pressure

GRADUALLY the way is being cleared for development of a satisfactory machine and a method for testing and evaluating extreme pressure lubricants.

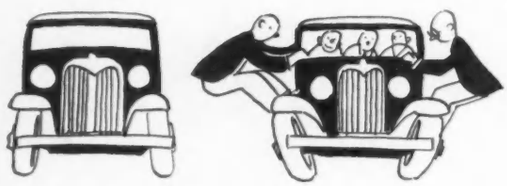
Extensive work done at the Bureau of Standards under Lubricants Research Committee auspices in testing and attempting to correlate results obtained from existing machines brought, according to subcommittee chairman H. W. Alden, two major facts: (*a*) None of the machines tested tell the whole story, and (*b*) no two of the machines agree with one another.

Out of its experience in making these tests, however, the Bureau of Standards group has developed a new test machine, in which many subcommittee members see wide possibilities. The new machine was exhibited and explained to the subcommittee members at a meeting in January. It was voted to absorb the cost of the development of the machine from the subcommittee's fund and the Bureau was instructed to proceed with testing of nine lubricants on it.

A special subcommittee consisting of H. C. Mougey, chairman, W. H. Graves, G. M. Maverick, and R. E. Wilkin was appointed to collect, analyze and pass on to the Bureau of Standards service data on the nine lubricants being tested at the Bureau.

Alignment

TRADE journals are going to be asked to include in their published specifications for camber, caster, toe-in and king-pin inclination supplementary data as to



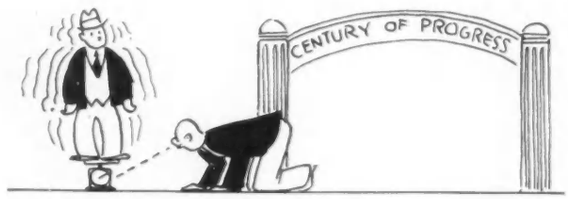
whether the specifications do or do not include passengers in the car and whether caster is measured with weight on or off the tires.

This request will be made by the Front Wheel Alignment Research Subcommittee after it has compiled these data. The original compilation will be sent to the trade press, according to present plans, after which the publishers will be asked to secure the similar data direct from manufacturers in the same questionnaires by which they obtain other car specification data regularly.

Chairman B. J. Lemon thinks, incidentally, that his subcommittee's past experience in the passenger-car field might well be made to apply to collection of data of alignment specifications for trucks and buses in order that the ground may be cleared for work of a bus and truck committee on front wheel alignment which might be established if so desired, at some future meeting of the S.A.E. Research Committee.

Wabblemeter

THE wabblemeter, well-tried tester of human fatigue, is on its way to prominence again. Arrangements are contemplated for its appearance at the Chicago Century



of Progress Exposition. And it won't be any casual visitor either.

It will be there at the recommendation of Dr. Fred A. Moss acting on the special request of Dr. Donald A. Laird, director of the Psychological Laboratory at Hamilton, N. Y., who plans to make it a permanent part of the equipment he is to use in studying the diurnal fatigue level of visitors at the Fair. Its appearance and use will be arranged by a special subcommittee of the S.A.E. Riding Comfort Committee, headed by F. F. Chandler of Ross Gear & Tool Co.

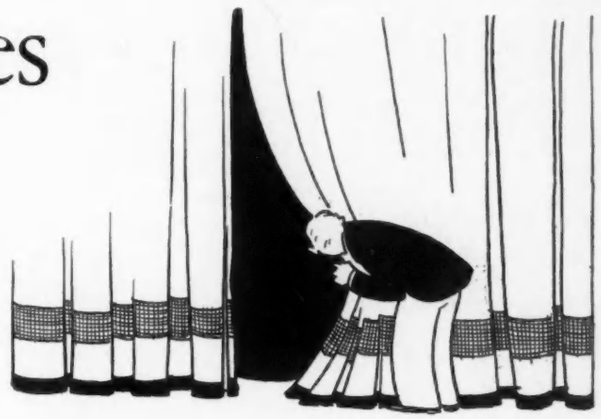
This same subcommittee has been delegated by the riding-comfort group "to negotiate with Vincent Bendix, relative to renewal of the contract for the manufacture of the wabblemeter, and concerning steps which might be taken by the manufacturer or the committee or both to facilitate the production and distribution of the wabblemeter in all the various fields of its application."

Free-Wheeling

PRESENT classification numbers for free-wheeling lubricants are to be continued in their present status of "general information." So voted the Lubricants Division of the Standards Committee in January. Some committee members claim that tests show oils not coming within the classification of free-wheeling lubricants give equally satisfactory results, but others, arguing for continuance of the classification, say that there are in operation many cars having free-wheeling units which must be lubricated with oils coming within the classification. At any rate, the classification is being continued.

This same division is about to go to work on the establish-

the Committees



ment of a standard nomenclature for oils and greases for chassis. Included will be, probably, pressure-gun greases, universal joint greases, wheel bearing greases and water pump greases. Data are being gathered from vehicle manufacturers now as regards the types of lubricants used, etc.

The Division has also appointed a committee to draft a standard questionnaire form for the collection of lubrication data.

Morocco

NEW headlight regulations in the French protectorate of Morocco caused a request for S.A.E. Lighting Division opinion as to whether or not headlights on American cars can be used without increasing hazards of operation as compared to the French type, on which projected regulations are based.

If new regulations go in force, say Morocco dealers representing American makes of cars, either the lamps themselves

on American cars must be altered or there must be a complete change in the lamps supplied as original equipment, entailing a cost of from 300 to 400 francs per car.

Since the members of the Lighting Division are communicating directly with A. W. Childs, Department of Commerce automotive division chief, the opinions aren't available at the moment. According to last accounts, 17,997 cars and 7563 trucks are operated in Morocco; and 72 American cars were shipped there in January, 1933.

Simplify

STANDARDIZATION Policy Committee is being asked to consider the possibility of simplifying the present classification of specifications. Says a recent summarizing paragraph in a memorandum from Standards Manager Burnett to this committee:

"Evidently, the variety of specifications of different status, the lack of appreciation by many of just what each status signifies, and the increasing industrial national and international standardization of all kinds of specifications, codes, etc., make it desirable to consider simplifying our S.A.E. classification of specifications. Possibly the best way toward this end will be to simplify the status designations, and it is suggested that consideration be given to publishing S.A.E. specifications with one of only two designations, namely:

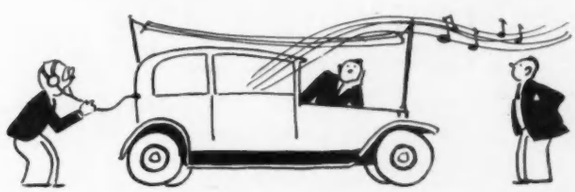
I. S.A.E. STANDARDS (to include present S.A.E. Standards and Recommended Practices).

II. S.A.E. INFORMATION (to include all other data bearing on S.A.E. Standards or Recommended Practices that are of sufficient value to warrant publication by the Society)."

There is plenty more that could be said on this subject, as indicated in the three-page memorandum referred to, but the Standardization Policy Committee is merely being asked to start thinking and talking about the whole question at this time.

Radio

AUTOMOBILE radio installations are getting more and more attention from the Society. Special subdivision of Standards Committee, which has been working on the subject for some time, has been cooperating effectively with committee of the Radio Manufacturers Association. Progress is being made.



Work is being continued on mounting dimensions for chassis and loud speakers; car antennas—the most serious problem in automotive radio at present, according to some—are being studied carefully; problems of additional battery current requirements are being delved into; and a subcommittee has been appointed to go into the subject of wiring automobile receivers.

Details of the progress being made in some of these studies will be ready for JOURNAL publication soon. They will have a widespread interest even outside the group technically interested.

Reference Table
for use with

Truck Rating Performance Factor

WITH the use of the proposed method of motor truck rating as given on page 15 of the March issue of the S.A.E. JOURNAL, the performance factor PF will be given by the manufacturer in his catalog or sales literature.

With this, from the accompanying reference table can be selected the grade in per cent that the truck should negotiate in high gear at a given speed, provided it is equipped with properly specified tire size for the vehicle gross weight.

Likewise, there can be determined through use of this table, the speed at which the vehicle should negotiate a grade of known per cent.

The values in the table were derived from the formula:

$$\text{Per cent grade} = \frac{\text{Performance Factor}}{\text{Miles per hour}} - 1.5$$

The grades given in the table are based on the performance factor rating for road resistance of 30 lb. per ton.

Performance Factor, P F	Grades in Per Cent at Various Speeds								
	Miles Per Hour in High Gear								
	45	40	35	30	25	20	15	12	8
100	0.7	1.0	1.4	1.8	2.5	3.5	5.2	6.8	11.0
105	0.8	1.1	1.5	2.0	2.7	3.7	5.5	7.2	11.6
110	0.9	1.2	1.6	2.2	2.9	4.0	5.8	7.7	12.2
115	1.1	1.4	1.8	2.3	3.1	4.3	6.2	8.1	12.9
120	1.2	1.5	1.9	2.5	3.3	4.5	6.5	8.5	13.5
125	1.3	1.6	2.1	2.7	3.5	4.7	6.9	8.9	14.1
130	1.4	1.7	2.2	2.8	3.7	5.0	7.2	9.3	14.8
135	1.5	1.9	2.4	3.0	3.9	5.3	7.5	9.7	15.4
140	1.6	2.0	2.5	3.2	4.1	5.5	7.9	10.2	16.0
145	1.7	2.1	2.7	3.3	4.3	5.7	8.2	10.6	16.7
150	1.8	2.2	2.8	3.5	4.5	6.0	8.5	11.0	17.3
155	2.0	2.4	2.9	3.7	4.7	6.3	8.8	11.4	17.9
160	2.1	2.5	3.1	3.8	4.9	6.5	9.2	11.8	18.5
165	2.2	2.6	3.2	4.0	5.1	6.7	9.5	12.2	19.1
170	2.3	2.8	3.4	4.2	5.3	7.0	9.8	12.7	19.8
175	2.4	2.9	3.5	4.3	5.5	7.3	10.2	13.1	20.4
180	2.5	3.0	3.7	4.5	5.7	7.5	10.5	13.5	21.0
185	2.6	3.1	3.8	4.7	5.9	7.7	10.8	13.9	21.6
190	2.7	3.2	3.9	4.8	6.1	8.0	11.2	14.3	22.3
195	2.8	3.4	4.1	5.0	6.3	8.3	11.5	14.8	22.9
200	2.9	3.5	4.2	5.2	6.5	8.5	11.8	15.2	23.5
205	3.0	3.6	4.4	5.3	6.7	8.7	12.2	15.6	24.1
210	3.2	3.7	4.6	5.5	6.9	9.0	12.5	16.0	24.7
215	3.3	3.9	4.7	5.7	7.1	9.3	12.8	16.4	25.4
220	3.4	4.0	4.8	5.8	7.3	9.5	13.2	16.8	26.0
225	3.5	4.1	4.9	6.0	7.5	9.7	13.5	17.2	26.7
230	3.6	4.2	5.1	6.2	7.7	10.0	13.8	17.6	27.2
235	3.7	4.4	5.2	6.3	7.9	10.3	14.2	18.1	27.9
240	3.8	4.5	5.4	6.5	8.1	10.5	14.5	18.5	28.5
245	3.9	4.6	5.5	6.7	8.3	10.7	14.8	18.9	29.1
250	4.0	4.7	5.7	6.8	8.5	11.0	15.2	19.3	29.7
255	4.1	4.9	5.8	7.0	8.7	11.3	15.5	19.7	30.4
260	4.3	5.0	5.9	7.2	8.9	11.5	15.8	20.2	31.0
265	4.4	5.1	6.1	7.3	9.1	11.7	16.2	20.6	31.6
270	4.5	5.2	6.2	7.5	9.3	12.0	16.5	21.0	32.3
275	4.6	5.4	6.4	7.7	9.5	12.3	16.8	21.4	32.9
280	4.7	5.5	6.5	7.8	9.7	12.5	17.2	21.8	33.5
285	4.8	5.6	6.7	8.0	9.9	12.7	17.5	22.2	34.1
290	4.9	5.7	6.8	8.2	10.1	13.0	17.8	22.7	34.7
295	5.0	5.9	6.9	8.3	10.3	13.3	18.2	23.0	35.3
300	5.1	6.0	7.1	8.5	10.5	13.5	18.5	23.5	36.0

Speed in m.p.h. to be determined from manufacturer's specifications covering size of tire appropriate for Gross Vehicle Weight.

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between

Feb. 10, 1933, and Mar. 10, 1933

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (S M) Service Member; (F M) Foreign Member.

BROWNE, CHARLES DENNIS (A) manager for Canada, C. C. Wakefield & Co., Ltd., 80 King Street, West, Toronto, Ontario, Canada.

CALLAHAN, JOHN G. P. (J) sub-teacher of industrial processes, Haaren High School, 59th Street and Tenth Avenue, New York City; (mail) 2716 Avenue L, Brooklyn, N. Y.

DUNNING, CHESTER B. (J) machinist, United States Navy, U. S. S. Breckinridge, San Diego, Calif.

FISHER, CLARENCE E. (J) designer, Glenn L. Martin Motors Co., Baltimore, Md.; (mail) 2605 Hamilton Avenue.

GRANVILLE, ZANTFORD D. (M) president, chief engineer, Granville Aircraft, Inc., Springfield Airport, Springfield, Mass.

HALL, GLENDON C. (J) aviation ignition repairman, Hawaiian Air Depot, Luke Field, T.H.; (mail) Box 156.

HARGRAFT, JOHN S. (A) manager, Ontario Steel Products Co., Ltd., Division C, Chatham, Ontario, Canada.

HAUSER, ERNST A., Prof. Dr. (F M) Phil. F.I.R.I., Metallgesellschaft A. G., Frankfurt/Maine, Germany; (mail) No. 170, Wimpassing im Schwt., N.-Oe., Austria.

HAZLITT, CECIL JOHN (F M) service manager, Larke, Neave & Carter, Ltd., 177-185 William Street, Sydney, Australia.

IMPERIAL JAPANESE NAVY (Departmental) Inspector's Office, Room 212, 1 Madison Avenue, New York City; Representative: Akaba, G., Lieut. Com., engineer.

KETTANEH, FRANCIS ANTHONY BERNARD (F M) managing director, Eastern Motor Co., Ltd., Avenue Gouraud, Beyrouth, Syria; (mail) Post Office Box 242.

LAIRD, GEORGE ALEXANDER WM. (M) engineer, Studebaker Corp. of Canada, Ltd., Walkerville, Ontario, Canada.

LORD, THOMAS (M) general manager, Lord Mfg. Co., Erie, Pa.; (mail) 36 Penn Building.

MALLEY, JAMES G. (J) superintendent of maintenance, Buckeye States, Inc., American Stages, Inc., 514 West Rich Street, Columbus, Ohio.

MINSHALL, E. MORTON (A) service department, Autocar Co., Ardmore, Pa. (mail) 232 Henley Road, Philadelphia.

RICHARD, NICHOLAS (S M) design draftsman, Naval Aircraft Factory, Philadelphia; (mail) 137 Haddon Avenue, Collingswood, N. J.

SCOTT, A. GORDON (A) lubrication engineer, Imperial Oil, Ltd., 56 Church Street, Toronto 2, Ontario, Canada.

SPURR, EDWARD (F M) experimental designer, Raymond Mays, Eastgate House, Bourne, Lincolnshire, England; (mail) 29 Newlands Avenue, Bradford Moor, Bradford, Yorkshire, England.

TEAGUE, ARNOLD L. (J) student, industrial arts, San Jose State Teachers College, San Jose, Calif.; (mail) 503 South Eighth Street.

WALT, I. ROBB (J) student, industrial arts, specializing in automobiles, San Jose State Teachers College, San Jose, Calif.; (mail) 210 South Eighth Street.

Applications Received

The applications for membership received between Feb. 15, 1933, and Mar. 15, 1933, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

ADAMS, JOHN Q., regional sales manager, Four Wheel Drive Auto Co., Clintonville, Wis.

BLATTNER, ADOLPH A., factory distributor, Liberty Avenue at 36th St., Pittsburgh, Pa.

BROSELL, EDWARD S., salesman, J. J. Hart, Brooklyn, N. Y.

CAPELLINO, CHARLES A., aero engineer, Naval Aircraft Factory, Navy Yard, Philadelphia.

CURREY, ALLAN ROBERT, general vehicles supervisor, Bell Telephone Co. of Canada, Montreal, Que., Canada.

DRAPER, WILLIAM BADEN, service manager, General Motors Argentina S. A., Buenos Aires, Argentina, S. A.

DUNSTON, HUBERT W., student, Northeastern Univeristy, Boston.

EBEL, ISABEL C., teacher, Brooklyn Technical High School, Brooklyn, N. Y.

HAYES, OSWALD, contracts engineer, Solex Ltd., Solex Works, London, N. W. 1, England.

JONES, ARTHUR H., service manager, The Schebler Carburetor Co., Inc., New York City.

KHARLAMOFF, NICHOLAS M., director, Central Aero., United Aircraft Industries of U. S. S. R., Moscow, U. S. S. R.

MEVAY, FRANCIS, stress analysis, General Aviation Mfg. Co., Baltimore.

MOORE, CLARENCE EDWARD, foreman, rebuild shop, Buckeye Stages Inc., Columbus, Ohio.

MULIT, LLOYD H., research engineer, Tide Water Oil Co., Bayonne, N. J.

MULLER, RUDOLPH J., consulting automotive engineer, Brisbane, Queensland, Australia.

PARKINSON, ROBERT, salesman, J. J. Hart, Brooklyn, N. Y.

POBEREJSKY, JOSEPH I., Director, Research Institute, United Aircraft Industries of the U. S. S. R., Moscow, U. S. S. R.

REICHLE, WILLIAM J., automotive inspector, The Kroger Grocery & Baking Co., Cincinnati, Ohio.

SANKEY, COL. HAROLD, director, Joseph Sankey & Sons Ltd., Wellington, Shropshire, England.

SIMONS, STANLEY, instructor, Provincial Institute of Technology and Art, Alberta, Canada.

STARCHENKO, GEORGE I., vice-president, All-Union Aircraft Engine Trust, Moscow, U. S. S. R.

STEILING, CARL H., 5004a Sutherland Ave., St. Louis, Mo.

STOLPER, ISRAEL, general manager, Armature Replacement Co., Boston.

THICKE, CLAUDE S., comptroller, Hayes Manufacturing Co. Ltd., Vancouver, B. C., Canada.

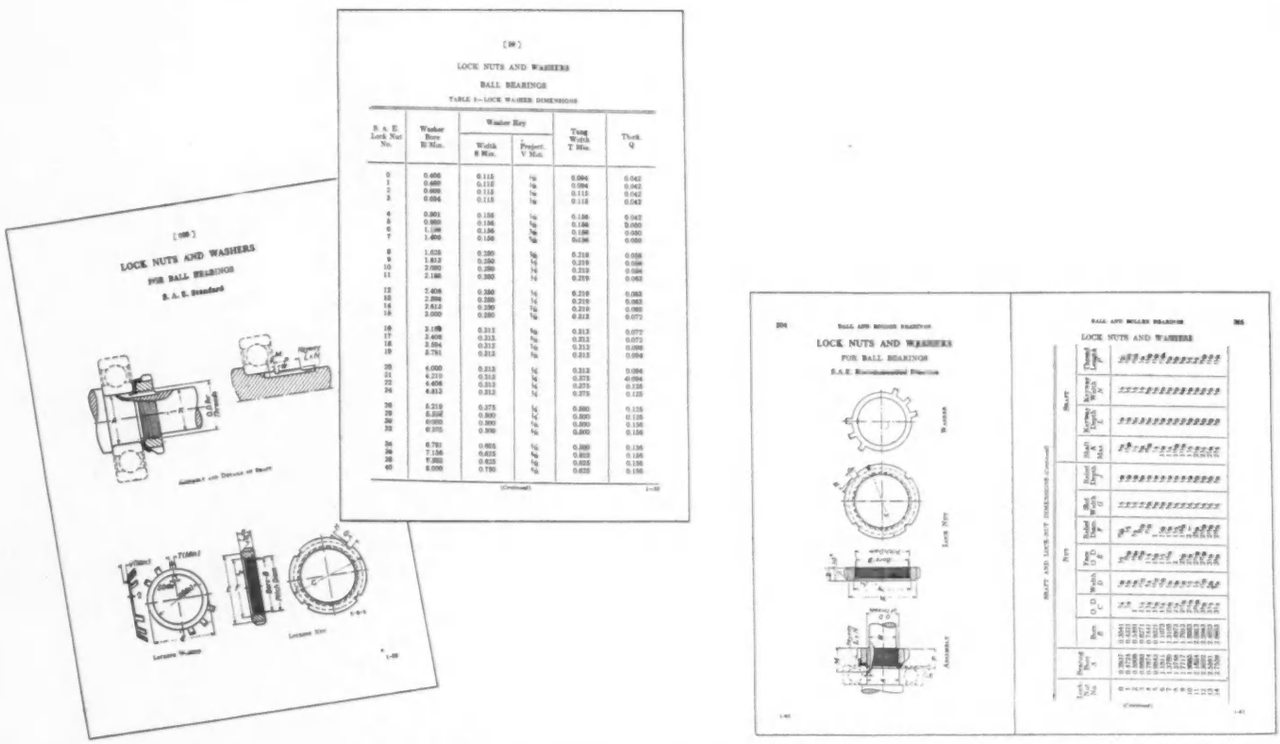
WILMORE, KENNETH M., secretary and treasurer, in charge of engineering and cataloging, The Dall Motor Parts Co., Cleveland.

New Standards Handbook Is Larger in Size and More Complete

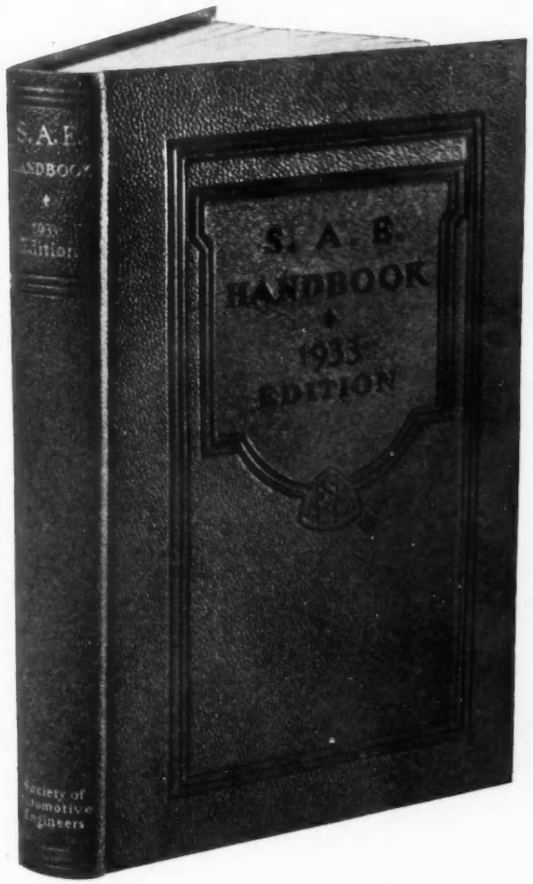
PROGRESS in the development and use of engineering standards for parts, materials, ratings and codes used by automotive manufacturers has made the S.A.E. Handbook a widely used publication of outstanding value in the automotive industry and in many allied industries because of their use of materials, parts, and other specifications included in the standards. To keep well abreast of this growth, the Council of the Society has decided that the 1933 edition shall be a complete new volume incorporating the supplements issued since the 1931 edition, in a larger size that will make it a still better publication.

This is only the second major change in the form of the Handbook since it was started in 1911, the other being a transition in 1926 from a loose-leaf to the bound volume.

The new size will be 5⅝ in. wide by 8⅜ in. high. The old size was 4¼ x 7¼ in. The new size, therefore, gives an increase in page area of about 45 per cent and makes it possible to print many standards complete on one page which previously have required two pages. As the new volume will be considerably thinner, it will be a more convenient form to carry and use. The general design of the binding and covers will be the same as recent editions.



Pages of new handbook (left) compared with those of 1932 edition (right). The new page size is 5⅝ in. wide by 8⅜ in. high, making an increase in page area of 45 per cent.



Here is what the 1933 S.A.E. Handbook will look like.

Convenience in using the Handbook is one of its important features. As the S.A.E. specifications are in the main of nine general types, they will be grouped into as many sections in the new Handbook, namely, Units, Parts and Fittings; Processed Materials; Fabricated Materials; Screws, Bolts and Washers; Tests, Ratings and Codes; Transportation and Maintenance; Tools and Production Equipment; Nomenclature and Definitions; and Miscellaneous Specifications. There also will be a section for the S.A.E. Standards Committee Regulations, for the American Standards approved under procedure of the American Standards Association that are of use to the automotive industry, and for the General Index of the Handbook.

Loose-leaf Service

The loose-leaf service of Handbook pages for miscellaneous uses has been maintained by the Society since the bound Handbook was first issued in 1926, and this service will be continued to supply those wishing to purchase copies of only single specifications and for use by Committees in their work.

Distribution of the new edition of the Handbook directly through members of the Society will take it into nearly 3000 manufacturing and business organizations in the United States and throughout the world, including Canada, Mexico, Cuba and Trinidad; Argentina, Brazil, Chile and Peru; Egypt, Nigeria, Rhodesia and the Union of South Africa; China, India and Japan; Australasia; England, Ireland and Scotland, and practically all of the continental countries of Europe. In addition to these, several hundred copies are distributed during the year in the United States and abroad.

World-wide use of the S.A.E. Handbook has come about mainly because of the direct value and the essential usefulness of standards which have been developed by the industry as represented in the Society and its Standards Committee which is composed of well qualified engineers and executives. The standards have been a main factor in making modern mass production possible. Their use, extending into nearly every department of industry and a large part of commerce, has resulted in reducing the cost of manufacture, distribution, servicing and use by many millions of dollars a year. It would be impossible to estimate accurately the extent of their value to those who use them, from the draftsman to the executive, in engineering, production, purchasing, sales and the use of products into the building of which they enter.

It is interesting to note in this connection that S.A.E. Standards have become the basis or have been adopted bodily as the national standards in several countries abroad.

When the new edition of this Standards Handbook is received by the members of the Society, they will find it a clearer, better and more convenient publication, designed to meet as nearly as possible the great variety of ways and conditions in and under which it is used. Distribution will be made as soon as possible, probably by the end of April.

Other Standards Publications

The standard testing forms including the rules and directions, specification sheets, log sheets and curve sheets for both gasoline and Diesel engines are printed separately on 8½ x 11 sheets which are available from stock and which are widely used for recording permanently engine test data. The curve sheet forms are on stock suitable for making blueprint copies of the curve plotted on them.

When the first production standards were adopted by the Society, it was decided after a canvass of production members that the Production Engineering Standards would be published in separate pamphlet 8½ x 11, this being the size most generally useful to the production engineers. These reports include plug and ring gages, Woodruff key-slot cutters and gages, cut and ground taps and tee slot bolts, nuts, tongues and cutters. Although many of the tables in these standards are rather large, the possibility of including the Production Engineering Standards in a future issue of the new size Handbook is being considered in order eventually to make it a complete volume of all the standards and recommended practices adopted by the Society.

What Members Are Doing

W. E. England

W. E. England has joined the Auburn Automobile Co. as experimental engineer in charge of all of the experimental work. Mr. England has been a member of the Society since 1919, and besides serving on the Transmission Division of the Standards Committee, was Chairman of the Cleveland Section of the Society in 1930.

B. B. Puddy has been engaged as engineer and accounting student for Geo. A. Touche & Co., Toronto, Can. He previously held a similar position with Robertson, Robinson, McConnell & Dick, also of Toronto.

A. W. Reader has severed connections with the Alemite Corp., Detroit, where he was sales engineer. His plans for the future have not been announced.

Richard L. Underwood, patent lawyer, has transferred his office from Detroit to Washington, D. C.

Charles T. Coleman, consulting transportation engineer, is now with General Motors Truck Co. He is located in Washington, D. C.

Joseph A. Scira is no longer garage superintendent for Lewis & Conger, of New York City, as that firm has disposed of all trucks and garages recently.

W. B. Kinner

Winfield B. Kinner has resigned as president and general manager of the Kinner Airplane and Motor Corp., to head the new Security National Aircraft Corp., of Downey, Calif.

Rene M. Petard, a Life Member of the Society, recently announced the formation of the S. I. B. E. L. Company, of Paris, France, of which he is president and general manager. The S. I. B. E. L. Co. is an international sales corporation, for the distribution of materials, patents, manufacturing rights, and export counsel. Prior to the formation of this new organizaton, Mr. Petard was consulting engineer, technical and sales, for cars, trucks and tractors with Domaine de la Dessenderia a Mosnac, at Charente, France.

Charles A. Lendl is now employed as an aeronautic engineer with the General Aviation Mfg. Corp., Dundalk, Md. He previously was designer for the Consolidated Aircraft Corp., Buffalo, N. Y.

R. C. Blackinton is now working as engineer on special problems for the Cadillac Motor Car Co., at Detroit, Mich., having resigned as chief engineer of the Reed Prentice Corp., Worcester, Mass.

Charles C. Cross, formerly of Briggs Mfg. Co., Detroit, is now assistant engineer in the body division of the Chrysler Motor Corp., Detroit.

E. W. Griffith has been appointed factory representative for the F. A. Smith Mfg. Co., Rochester, N. Y. He previously was owner and manager of the Griffith Sales Engineering Co., Detroit.

R. E. Carlson

R. E. Carlson has joined the Tung-Sol Lamp Works, Inc., in the capacity of sales engineer, with headquarters in its Detroit office, 4612 Woodward Ave. Mr. Carlson is well known to the industry, having spent the past ten years with the Bureau of Standards, Edison Lamp Works and Westinghouse Lamp Company.

Earle V. Hennecke

Earle V. Hennecke, former MotoMeter president, is to head Automotive Equipment, Inc., a recently formed corporation which will build and market a new line of automotive products for the replacement trade. Specific items in the line have not yet been announced.

Mr. Hennecke was president of the Automotive Equipment Association in 1927, and has been an associate member of the Society since 1924. For the last few years he has operated his own merchandising organization, Earle V. Hennecke, Inc.

G. M. Bicknell, a member of the Society since 1920, was the guest of honor of a testimonial dinner tendered by officials of the Carter Carburetor Corp., in recognition of his service of more than 20 years with that company, of which he is chief engineer.

Wm. Edgar John is now sales engineer in the industrial division of the Hall-Scott Motor Co., New York City. He previously was manager of the New York office of the Sterling Engine Co.

Employment to the Rescue!

"WHEN a man is discharged there is a loss in net national income, expressed in dollars, about 3½ times the saving through this cut in wages. * Discharge of personnel and the accompanying reduced payrolls and reduced will-to-buy result in decreased net income far in excess of the savings in wages. *** To bring about recovery, therefore, it is only necessary to reverse the present trend; to start either large scale purchasing or large scale reemployment, which amounts to the same thing"—so says our President, Dr. H. C. Dickinson, in his proposal of proper remedies for present ills.**

In this rehabilitation program the Society offers its services through the Employment Department as a point of contact for employer and employee. Every man on the list is backed by the distinction of membership in the S.A.E., so that recourse to the Employment Service of the Society should be the first thought when increasing personnel—which, according to many, is the first step on the road to recovery.

Remember a Member!

Glenn Muffly has opened offices in New York City and is engaged in organizing a patent holding company. He formerly was consulting engineer for Copeland Products, Inc., and served in a similar capacity in the refrigeration division of the National Electric Manufacturers Association.

George W. Dunham also a consulting engineer, is associated with Mr. Muffly in his new project.

That work in the United States antedated development of the new Rohrback "paddle airplane" recently demonstrated in Germany was revealed by Dr. George W. Lewis, director of research for the National Advisory Committee for Aeronautics, during a meeting of aircraft engineers and designers in New York City in January.

Dr. Lewis stated that for a period of more than five years the N.A.C.A. had been studying and the Massachusetts Institute of Technology and the Guggenheim School of Aeronautics had been testing a design and model of such a machine invented by H. H. Platt. Theoretical analysis, he said, indicates that the Platt machine can take off and land vertically and, in case of engine stoppage, the wings will autorotate, making possible a safe landing in a small space.

Mr. Platt, who is chief engineer of the Wilkening Mfg. Co. of Philadelphia, has been a member of the Society since 1925, and is known in the automotive industry through his development work on the process of heat-shaping in the manufacture of piston-rings. He filed an application for a patent covering his new type of airplane on Dec. 3, 1927, and the patent was issued March 10, 1931.

Russell James Parrish

A heart attack caused the sudden death, on Jan. 31, of Russell James Parrish, former assistant engineer and chief draftsman for the Chevrolet Aircraft Corp., at his home in Richmond, Ind. Mr. Parrish was born in Richmond 42 years ago and, after graduating from Purdue University in 1914 with the degree of B.S.M.E., entered the employ of the National Automatic Tool Co., Richmond, Ind., as a draftsman. Following this position, he was employed successively by the Hooven, Owen, Rentchler Co., Hamilton, Ohio; the Richmond, Ind., division of the Pennsylvania Railroad Co., Richmond Safety Gate Co., the Remy Electric Co.; Wright Field, at Dayton, Ohio, where he was checker and aeronautic designer and was later transferred to the Power Plant Branch. He also taught engine design to the officer-students of the Air Corps Engineering School. Mr. Parrish was located at Wright Field from October, 1918 to November, 1929.

William R. Grundemann

William R. Grundemann, of the national sales division, Texas Co., of New York City, died on Dec. 31, 1932.

Born in New York 40 years ago, Mr. Grundemann's early training was received at Sheffield Scientific School and as a tester-mechanician for the Willys-Overland Co. His work in the automotive field was largely in service and experimental capacities.

In 1925 he was owner and manager of the Grundemann Service Corp., Redondo Beach, Calif., and in 1930 he was employed by the Texas Co., as automotive engineer in the Pacific Coast territory, having been transferred to New York City last year.

Besides being a member of the Southern California Section of the Society, Mr. Grundemann was also a member of the American Technical Society.

Personal Opinions

(Being terse phrases spoken or written by Members or by their guests and ferreted from their context by an editor in an inquiring mood)

If we are to maintain our military supremacy in the air, we must devote a great deal more thought, energy and money than we have been during the past to the improvement of our military airplanes.—*James R. Doolittle*

A drowning man's judgment is not good.—*W. H. Beal*

The operation of public transit facilities in a given community should be a monopoly under suitable regulation.—*C. O. Guernsey*

The automobile industry is unique in its courageous resistance to the spirit of defeatism to which American industry as a whole has surrendered during this depression.—*Dr. Virgil Jordan*

Half the trouble in a Diesel job can be traced to the men who put it on paper the first time.—*B. C. Edwards*

People don't buy on merit until merit is made clear to them in a dramatized way.—*Walter P. Chrysler*

Every death caused by a motor vehicle accident removes a prospective purchaser. —*J. P. Bickell*

As long as you can see your own mistakes you don't need a teacher—but as soon as you think your work is good—go get a teacher quick!—*W. B. Stout*

The body designer is faced with the necessity of striking a happy medium between the ornate, which must not be accused of being gaudy, and the simple, which cannot go so far as to be in good taste.—*J. W. Frazer*

The surest solution of the large-tire problem is a closer exchange of real facts—an understanding that amounts to an informal conspiracy among the engineers in the car, tire and wheel industries, to promote a diffusion of the best knowledge we have of the virtues and shortcomings of the super balloon.—*B. J. Lemon*

Colonel Frank E. Smith

Col. Frank E. Smith, a Member of the Society since 1911 and a pioneer in the automotive field, succumbed to pneumonia on Feb. 7.

He was president and a director of Servel Affiliated Companies, New York City, a position which he had held since 1928.

Colonel Smith was born in 1873, and his technical training was received in the Rhode Island School of Design. His early experience was obtained in the employ of the American Locomotive Co., where he became assistant manager of the Cooke and Rogers Plant, at Paterson, N. J. Later he became plant manager of the American and British Mfg. Co. at Bridgeport, Conn., where he was instrumental in the designing and building of the Orsen automobile. He also designed four-cycle motors for the Chalmers Motor Co., Velie Motor Vehicle Co., International Harvester Co., Staver Carriage Co., Columbus Buggy Co., and others.

In June, 1910, Colonel Smith took charge of the New Castle, Ind., plant of the Maxwell-Briscoe Motor Co., and in 1913 was made vice-president of the J. D. Maxwell Motor Corp., of Indianapolis. In 1914 he became vice-president and general manager of the American Motors Co. of Indianapolis; in 1916 was made a trustee of the Premier Motor Mfg. Co. In 1917 he was elected president of the Universal Motor Products Co. of Indianapolis, a position he resigned to become a Major in the Signal Corps of the United States Army.

Besides having been a member of the Detroit and Metropolitan Sections for a number of years, Colonel Smith was an active member of the Indiana Section during his early years in the Society, and in 1917 served as Secretary of that Section.

Sezo Shinjiro Hatashita

Following an illness of seven months' duration, Sezo Shinjiro Hatashita died recently at his home in Wakayama, Japan.

Mr. Hatashita was elected to Member grade in the Society in March, 1911, at which time he was chief draftsman of the Russell Motor Axle Co., of North Detroit, Mich. His last connection with the industry was as experimental and designing engineer for the Reo Motor Car Co., of Lansing, Mich.

Born in Wakayama in 1874, Mr. Hatashita received his technical education in the Tokyo Technical School. After coming to the United States he was first employed from 1899 to 1903 by the Michigan Peninsular Car Co. He began his career in the automobile industry with the Olds Motor Works, in Detroit, in 1903, then, following the organization of the American Car & Foundry Co., he was employed by it in the steel-car department. For the four years from 1906 to 1910 he was variously engaged in the engineering department of the Russell Wheel & Foundry Co., and thereafter was successively connected with the Northern Mfg. Co., the Russell Motor Axle Co., the Carrier Motor Truck Co. as chief engineer, the Transportation Equipment Co. as chief engineer, the Trail Ford Corp., of Ann Arbor, Mich., the Relay Motors Corp., of Lima, Ohio, as engineer, and finally the Reo Motor Car Co. as experimental and designing engineer.

News of the Sections

"HASTY check shows Society members uninjured as result of earthquake in Southern California. Only a few members live in area most seriously affected." That's the most gratifying of all the Section news which came through this month. It came in a telegram from W. E. Powelson, secretary, Southern California Section, in response to a query from General Manager John Warner.

The most complete reports came this month from Pittsburgh, Milwaukee, Cleveland, New England, Northwest and Metropolitan meetings. "Met" report is full of information and is held over until next month so that proper space can be provided.

Buffalo, Syracuse, Indiana and Dayton sections did not hold meetings in March.

Philadelphia featured G. N. Seiger, director, metallurgical division, P. R. Mallory & Co., in a talk on the design and functioning of resistance welding electrodes, while H. S. Wash, instructor, Chevrolet Zone School, Eastern district, talked before the Baltimore group at its March meeting.

Southern California went through with its annual dinner-dance on March 18 despite earthquakes and had an attendance of 182. Officers for next year were nominated as follows: Chairman, C. H. Jacobsen, service manager, Moreland Truck Co.; vice-chairman, E. E. Tattersfield, president, Elec. & Carb. Engineering Co.; vice-chairman for aeronautics, W. B. Birren, western representative, Wright Aeronautical Corp.; secretary, W. E. Powelson, master mechanic, Fire Department, Los Angeles County; and treasurer, J. Jerome Canavan, Canavan-Kunkel Co.

Nothing had been heard from the following sections as we went to press: Canadian, Chicago, Detroit, Kansas City, Northern California, Oregon, St. Louis, Washington and Wichita.

Gadget Era Gone, Alex Taub States

Pittsburgh and Milwaukee Groups Hear Service Talk

The engineer too often overlooks the fact that his product frequently becomes more complex as it becomes more efficient, according to Alex Taub, Chevrolet's research engineer, who was the principal speaker at the Pittsburgh Section meeting on February 21 and at the Milwaukee Section gathering on March 1.

More than 200 members and guests at these two sessions heard Mr. Taub urge upon service men greater use of factory instruction books and emphasize the necessity for effective maintenance work if the manufacturer is to achieve his objective of placing "in every owner's hands a product able to operate at maximum efficiency for the longest period, with minimum upkeep cost."

"A high percentage of cars," he said, "never operate near their possibilities, since they are delivered full of friction and, since it takes about 2000 to 5000 miles to run in an automobile completely, it has ceased by that time to be of interest to the dealer, unless he is on his toes. Yet these are the cars that are ripe and with a little service care and understanding will be among the best performers; therefore a company's or a dealer's best selling assets."

Smoother original operation means greater sensitiveness to vibration, Mr. Taub pointed out, thus making necessary careful fits and balances in repair work if original smoothness is to be maintained. Such repair work is possible, in Mr. Taub's opinion, because he stated definitely that "There is no reason why a car or truck should not be a better product after being serviced than before."

Advocating a closer relationship between the engineer and the field service personnel, Mr. Taub concluded by stating that understanding of equipment today is vital because tomorrow will bring new designs with new efficiency which cannot be coped with except through a complete understanding of today's products.

"Research has been going forth by leaps and bounds," he said, "with an ever widening field. The era of the gadget has passed. New ideas, new fundamental products will be the life blood of competition."

Speed Charts Changes in Engines and Fuels

M.b.hp. and Octane Numbers Show Increase Since 1925

AN increase of 80 per cent in average maximum brake horsepower since 1925 and an increase in the average octane number of regular gasoline from 60 to 65 within the last two years, were some of the many results of present trends in engine and fuel design which were graphically illustrated in a comprehensive paper presented by F. R. Speed at a well-attended March meeting of the New England Section.

About half of this improvement in maximum brake horsepower, in Mr. Speed's opinion, is due to increases in engine speed and engine displacement. The other half he attributes to improvement in engine efficiency through increased volumetric efficiency, increased compression ratio, and, in a lesser degree, to improved cooling.

Other improvement data charted by Mr. Speed showed the following increases above those attained in 1925: Engine displacement, 14 per cent; r.p.m. at maximum brake hosepower, 27 per cent; horsepower per cubic inch, 55 per cent; brake mean effective pressure at maximum brake horsepower, 22 per cent.

In discussing data obtained on dynamometer tests which showed advantages of high compression design for commercial vehicle engines,

Mr. Speed contended that the data had been confirmed by field experience and he cited results obtained under regular operating conditions. Over a 6-months' period fuel economy as high as 20 per cent had been effected in one instance and performance greatly improved.

Regarding the past tendency of tractor manufacturers to build engines for operation on low grade fuels, Mr. Speed again presented field test data showing that a high compression tractor operating on Ethyl gasoline pulled 33 per cent more load and maintained a speed 7 per cent faster than a similar low compression unit operating on kerosene. In some cases, he pointed out, this ability of the high compression engine to do more work is far more important than the relative cost of fuels.

Mr. Speed's paper developed such a protracted discussion among the 100 persons attending the meeting that it was necessary for Dean A. Fales, Section Chairman, to call a halt reluctantly to avoid an all-night session. Some 32 members attended a dinner which preceded the meeting.

Student Branch Active

There has been much activity recently in the New England Student Branch, including several meetings, inspection trips to special exhibits of two manufacturers and visits to Boston automobile dealers.

One of the meetings was addressed by Mr. K. J. Howell on the specifications of the lower priced cars. At another meeting Ralph de Palma talked on the influence of racing on passenger car design.

Student members studied old designs at an interesting exhibit of old cars held by Noyes Buick. A trip to the Packard exhibit of precision methods used in fine car manufacture proved interesting and instructive. "Washington Birthday open house" was the occasion for the visits to Boston dealers.

Diesel Advantages Justify Interest

Cuts Fuel Consumption 30 to 50 Per Cent, Geschelin States

INQUIRING into the economic status of the Diesel engine at the Cleveland Section meeting this month, Joseph Geschelin, engineering editor of *Automotive Industries,* spoke favorably of its possibilities and related personal experiences on a cross-country trip in a Diesel-engined bus.

He emphasized his belief that the attention aroused by the Diesel is well merited because of its inherent economy, stating that "even if its fuel is taxed, even if the price of fuel were to approach that of gasoline, it has the advantage of cutting fuel consumption from 30 to 50 per cent."

James L. Myers acted as chairman of the meeting. Attendance totaled nearly 150 despite the presence of a national bank holiday.

Mr. Geschelin voiced four definite conclusions about the heavy-duty, high speed, automotive Diesel powerplant: (1) it can be built for about the same price as similar gasoline engines; (2) it can be built in about the same range of specific weight; (3) it possesses satisfactory performance in the way of acceleration, quick-starting, freedom from knock and smoke; (4) its economy continues to be better than that of improved gasoline engines.

Backing up these generalizations with a wealth of detailed facts and figures, he gave actual operating costs of several specific operations to bear out the soundness of his conclusions. Savage Transportation of San Francisco, he pointed out for example, now has in service five 6-cylinder Cummins Diesels in Indiana trucks. They carry a gross load of 34,000 lb. on a route of 1616 mi. for the round trip. Average m.p.g. for the round trip on the Diesel—7.9; average m.p.g. for the gasoline job—3.4. Reduction in fuel consumption is 100 (7.9 — 3.4) / 7.9 or 57 per cent in favor of the Diesel.

Diesel fuel costs $11.96 for the round trip, while Ethyl gas at 21 cents a gallon at the filling station in foreign states costs $99.75 for gasoline equipment. Saving in fuel cost per truck per trip in favor of the Diesel is $87.79. But since each truck makes six round trips per month, the saving per truck per month on a mileage of about 9000 miles per month is $526.74.

Purity Stores of San Francisco operates four Diesels, Mr. Geschelin stated, one a 4-cylinder Cummins, and three 6-cylinder Cummins. The four-cylinder job on a truck-trailer train of 50,000 lb. gross has averaged 10 mi. to the gallon over a period of 17,000 mi. The 6-cylinder truck-trailers hauling 34 tons gross have averaged better than 6 mi. to the gallon over a combined period of 70,000 mi.

Three gasoline trains doing the same work over the same routes do little better than 3.5 mi. to the gallon.

This company, Mr. Geschelin said, buys gasoline at 14 cents a gallon, tax included; fuel oil at 3 cents plus 3 cents tax which they pay voluntarily. On this basis the gasoline train costs 4 cents per mile for fuel while the Diesel is 0.88 cents per mile. Traveling an average of 5000 mi. per month, the cost of gasoline per truck is $200 per month, while the cost of fuel oil is $44. The Diesel truck therefore saves an average of $1872 per year on fuel.

Performance, Mr. Geschelin thinks, has been the stumbling block to a wider adoption of Diesel engines—at least in this country. In fact he reports that American observers who have studied European practice say that the performance of the European equipment would not be acceptable to the truck operators in this country.

"Yet," Mr. Geschelin asked, "is it safe to judge the Diesel engine merely on this basis? Let us remember that the sole object of European designers was to get economy. Performance was not even considered. Diesel experts in this country, as well as technicians identified with European development, assure us that improvement is possible and can be achieved. Certainly my experience in making the run on the Cummins equipped bus from New York to Los Angeles gave me a high regard for the performance ability of the Cummins Diesel."

Pangborn at Student Meeting

Clyde Pangborn, famous round-the-world flyer, spoke on March 17 at University Heights to a joint meeting of the New York University Student Branch of the Society of Automotive Engineers and the national engineering honorary society, Tau Beta Pi. Mr. Pangborn told of his flight around the world. The real purpose of this flight, he said, was to beat Post and Gatty's record. Mr. Pangborn and his co-pilot flew in a Bellanca high wing monoplane.

They landed in Seattle with no landing gear and, as a result, the plane nosed over as it landed. The co-pilot was slightly injured. The flyers were given a hearty welcome in Seattle and were welcomed later in New York by its mayor.

Mr. Pangborn's talk was followed by motion pictures in which were shown various test flights, takeoffs, and the smashup of the plane when it nosed over in the attempt to land.

Hedges Motor Has Floor at Northwest

Details of Double-Acting Engine Fully Described

STATING a firm conviction that as fast as the industry can be adapted to it, all internal combustion engines will hereafter be of the double-acting type or principle, Sherman Bushnell described the construction and operation of such a motor, invented by Harry Hedges of Seattle, to a large and interested gathering at the March meeting of the Northwest Section.

Mr. Bushnell, chief engineer of the Hedges company, displayed and operated a cut-away model of one cylinder of a two-way job and a 20 hp. motor. He stated that the company is now building a 6-cylinder motor for automobile use. The Hedges motor has been adopted by a large motor truck manufacturer and an outboard motor company.

Experiments with the engine are being made with a view to making it a Diesel also. In addition the company is taking a radical departure from conventional practice in designing an aircraft engine of 800 hp. with the tandem cylinder for installation in the wing.

In discussing the double-acting motor, Mr. Bushnell mentioned the longer life of internal combustion engines using the cross head and stated that in his opinion, this construction plus the double-acting principle, whereby each cylinder is made to do the work of two, indicated real progress in motor efficiency.

The inner and outer combustion chambers of the Hedges motor are identical. Port plugs are used over the inner head valves. The timing of the inner head varies somewhat due to the lower piston velocity on the inner power stroke. This tends to maintain fluid pressures and compensates for loss in displacement due to the area occupied by the piston stem. The piston is an aluminum disc carrying four rings and the piston stem is a hardened and ground steel tube.

One of the most important features is the use of contracting cast iron rings held in a split cast iron cage, which is kept in place by a bronze gland nut, for sealing the piston stem as it passes through the inner head. These rings float in the ring groove in the same manner as piston rings.

Another feature is the use in the cross head of comparatively small ball bearings instead of the usual forms of sliding surfaces. The small bearings, which travel back and forth between hardened steel races, weigh so little, Mr. Bushnell said, that a connecting rod, cross head, piston stem and piston can be designed to weigh no more than a similar assembly in conventional motors. This cylinder, he explained, can be used in any type of internal combustion motor and in any position.

Among other points mentioned by Mr. Bushnell, in describing the Hedges motor, were the following: Tolerances for piston are not critical; no cooling problem due in part to thick piston head; development of compression ratios up to 6 to 1; minimum vibration—the piston virtually floats in the cylinder; increases in thermal and mechanical efficiency; reduction in oil consumption (gasoline consumption is about the same as in the conventional motor).

Interest in the Hedges motor brought out the largest attendance at a Northwest Section meeting in more than a year, 106 being present. About half this number attended a dinner earlier in the evening. Charles C. Finn, Section Chairman, presided and C. H. Bolin, Chairman, presented the report of the Nominating Committee.

Council Chooses Chicago for Big Meeting

INSPIRED by a host of advantages in favor of the decision, the Council of the Society, at its Feb. 24th meeting, selected Chicago as the location for an ambitious combination of technical meetings known as the International Automotive Engineering Congress. Transportation, aeronautic, in fact big meetings of all S.A.E. professional activities will be included.

Drawing talent and attendance from many quarters, the Congress will take place with the Palmer House as headquarters, from Aug. 28 to Sept. 4 inclusive.

The Century of Progress Exposition will then be in full swing, and various other concurrent happenings, among them important air events, will give every automotive man reason to visit Chicago during the period of the S.A.E. Congress.

Upon recommendation of the Riding-Qualities Subcommittee and the main Research Committee, the Council voted that a suitable resolution be duly formulated and properly transmitted in the name of the Council to Dr. F. A. Moss, for his generosity and skill in the very effective handling and completion of the riding-qualities investigation that was covered by a final report presented at the Annual Meeting in January.

Appointments made by the Council on Feb. 24 included the Professional Activity Committee, listed below, that is to operate during the present administrative year under Vice-President A. E. Becker of the Fuels and Lubricants Engineering group.

A. L. Beall, Vice-Chairman

D. P. Barnard 4th	Ferdinand Jehle
T. A. Boyd	L. C. Lichty
Graham Edgar	J. B. Macauley
W. H. Graves	A. G. Marshall
H. D. Hill	Neil MacCoull
J. B. Hill	F. C. Mock
H. L. Horning	Arthur Nutt

T. C. Smith

Dr. Graham Edgar and H. L. Horning will serve respectively as Membership and Meetings Committee representatives for the Fuels and Lubricants Committee.

W. J. Cumming of the Surface Transportation Corp. was appointed a member of the Motorcoach and Motor Truck Division of the Standards Committee. He will represent the American Transit Association.

Appointment of B. B. Bachman to serve as Chairman of the S.A.E. Brake Committee was confirmed. Other members appointed to serve on this committee were H. C. Dickinson, A. F. Coleman, F. K. Glynn and D. G. Roos. This group is cooperating through the N. A. C. C. committee, of which D. G. Roos is chairman, with the motor vehicle commissioners.

To the Non-Ferrous Metals Division of the Standards Committee, E. W. Upham was appointed; and J. R. Adams, C. C. Stevens, J. A. Siegel and J. S. Tawresey were appointed to serve on the A. S. A. Sectional Committee on Classification and Designation of Surface Qualities.

Approval was granted by the Council of the appointment by Vice-President Winchester of Leo Huff, H. W. Kizer and A. Y. Dodge to serve on the Transportation and Maintenance Activity Committee.

At the instance of Vice-President M. C. Horine, Frank Fageol was named on the Motorcoach and Motor Truck Activity Committee.

Meetings Calendar

Baltimore—April 20

Emerson Hotel; Dinner 6:30 P.M.
Subject: Fuels

Buffalo—April 18

Hotel Statler—8:15 P.M.
Looking Ahead with Engineers—Norman G. Shidle, executive editor, S.A.E. JOURNAL

Canadian—April 19

Royal York Hotel; Dinner 7:00 P.M.

Chicago—April 4

Hotel Sherman—8:00 P.M. Buffet Supper served after meeting

Cleveland—April 10

Cleveland Club; Dinner 6:30 P.M.
Student Meeting—Address by C. B. Veal, research manager, S.A.E.

Dayton—April 3

This Section will participate in the meeting of the Indiana Section, at the Athenaeum, Indianapolis, Ind.

Indiana—April 3

The Athenaeum, Indianapolis; Dinner 6:30 P.M.
Why Not Prosper?—Dr. H. C. Dickinson, chief, Heat and Power Division, U. S. Bureau of Standards, and president, Society of Automotive Engineers
Forging Ahead with the S.A.E.—John A. C. Warner, secretary and general manager, Society of Automotive Engineers

Kansas City—April 7

Steuben Club; Dinner 6:30 P.M.
Addresses by Dr. H. C. Dickinson and John A. C. Warner

Metropolitan—April 20

Hotel New Yorker, New York City; Dinner 6:30 P.M.
What's Wrong with the Laws?—D. C. Fenner, manager, Public Works Dept., International Motor Co.
What Can We Do with the Existing Laws?—A. J. Scaife, consulting field engineer, White Co.

Milwaukee—April 5

Milwaukee Athletic Club; Dinner 6:30 P.M.
Addresses by Dr. H. C. Dickinson and John A. C. Warner

New England—April 12

Walker Memorial, Mass. Inst. of Technology, Cambridge, Mass; Dinner 6:30 P.M.

Northern California—April 19

Elks Club, San Francisco; Dinner 6:30 P.M.
Addresses by Dr. H. C. Dickinson and John A. C. Warner

Northwest—April 22

Bergonian Hotel, Seattle, Wash.; Dinner 6:30 P.M.
Addresses by Dr. H. C. Dickinson and John A. C. Warner

Oregon—April 21

Multnomah Hotel, Portland; Dinner 6:30 P.M.
Addresses by Dr. H. C. Dickinson and John A. C. Warner

Philadelphia—April 12

Engineers Club; Dinner 6:30 P.M.
Standardization of Fleet Operations—J. F. Winchester, coordinator and supervisor of motor vehicles, Standard Oil Co. of New Jersey

Pittsburgh—April 25

Fort Pitt Hotel; Dinner 6:30 P.M.

St. Louis—April 6

Coronado Hotel
Addresses by Dr. H. C. Dickinson and John A. C. Warner

Southern California—April 17

Los Angeles, Cal.
Addresses by Dr. H. C. Dickinson and John A. C. Warner

Syracuse—April 3

Onondaga Hotel; 8:00 P.M.
Aircraft Meeting

Washington—April 19

Racquet Club; Dinner 6:30 P.M.

Wichita—April 8

Addresses by Dr. H. C. Dickinson and John A. C. Warner

CERTAINLY the best is none too good in working units that are so vital to performance as are piston rings, pistons and pins. Lasting compression and perfect oil control are too important in themselves to allow of any consideration except "*results*," at *any* price.

That is why Sealed Power engineers are so anxious for opportunities to *prove* rather than *sell* their products. That is why Sealed Power has invested much in plant facilities, equipment and testing laboratories . . . . Build power with Sealed Power because it is power at its best.

SEALED POWER
Formerly The Piston Ring Company

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"SEALED POWER"

SEALED POWER PRODUCTS

Notes and Reviews

THESE items, which are prepared by the Research Department, give brief descriptions of technical books and articles on automotive subjects. As a rule no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.

AIRCRAFT

Der Sturzflug in Veränderlicher Luftdichte

By Fritz Becker. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Nov. 28, 1932, p. 659. [A-1]

Determination of the dynamic stresses imposed on aircraft during vertical dives is becoming a question of increasing importance. In its latest specifications for strength of aircraft, the German aircraft committee provided that the critical speed shall be 1.3 times the speed practicably attainable in flight. To calculate this speed, the changing air-density during vertical dives must be known. In this article a table is developed from which the required air-density can be ascertained without calculation.

La Topographie par Photographies Aériennes

By Jacques Dumas. Published in *Le Génie Civil*, Nov. 19, 1932, p. 503. [A-1]

An apparatus to interpret aerial photographs for map-making is described. An invention of M. R. Ferber, it is the most recent French development in the material of aerial mapping. Its operation, which is described, is said to achieve, over ground mapping, the advantages of accuracy, decreased expense and decreased time.

La Concurrence entre le Dirigeable et l'Avion

By Max Verneuil. Published in *Le Génie Civil*, Nov. 26, 1932, p. 526. [A-1]

The 150th anniversary of the first ascent of a dirigible balloon finds the lighter-than-air craft relegated to the background, for the most part, in favor of the heavier-than-air youngster of scarcely more than a quarter of a century's experience.

Whether these relative positions will be maintained is the query of the author, who analyzes the merits of both types of craft under the headings of regularity and speed of voyages, operating range, useful load, possibilities of improvement and over-all efficiency.

That France has abandoned the large dirigible is balanced by the German production of a remarkable commercially useful and technically important airship. The conclusion reached is that the future belongs exclusively to neither type of craft, but to both working cooperatively.

Du Navire Volant

By Claude Dornier. Published in *L'Aéronautique*, November, 1932, p. 336. [A-1]

That the field of transoceanic air transportation belongs to the giant flying-boat is the conclusion to which the author directs the material of this article. He traces the developments and accomplishments of this type of craft through three stages: the first flying-boat, the Do-X-1, launched in July, 1929; the Do-X-1a, in which the air-cooled engines of the first craft were replaced by water-cooled powerplants; and the two Italian-owned Fiat-engined Do-X-2 flying-boats.

On comparative performance figures of the latest flying-boat and of current modern airplanes, Herr Dornier bases the assertion that the former has the advantage in fuel consumption per ton-mile made good and in the ratio of payload to total weight. This distinction has been achieved, in spite of the lack of essential modification in the basic structure of the flying-boats, in the last six years. How much greater, he suggests, will be their advantage when their design incorporates the aerodynamic improvements now common to airplanes. Finally, he indicates the probable future development of the two types of aircraft which will increase still more the contrast between them in favor of the flying-boat.

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NOTES AND REVIEWS

Continued

La XIIIe Exposition Internationale de l'Aéronautique

By R-J. De Marolles. Published in *Le Génie Civil*, Dec. 3, p. 541; Dec. 10, p. 576; and Dec. 17, 1932, p. 605. [A-1]

Less representative than previous expositions, because of the absence of about 20 recent French models undergoing flight tests, the 13th bi-annual international aircraft show at Paris nevertheless included 61 exhibits, of which 47 were those of French and 14 those of foreign manufacturers. They were about equally divided between civil and military craft, the most numerous single class being that of private airplanes. Of these, 19 were shown, representing among themselves a diversity of types. The 61 exhibits were made up of 50 airplanes, 8 hydroplanes, 2 amphibians and 1 Autogiro. This last and the tailless S.G.A. Nieuport-Delage are reported to have constituted the two points of greatest interest.

The preponderance of the monoplane and single-engined craft, the growing popularity of all-metal construction, the continuing controversy between air and liquid cooling, increasing maximum speed with the inevitable reaction toward lower landing-speeds with special devices to facilitate landing—these are mentioned as some of the outstanding developments exemplified by the exhibits.

Descriptions of the individual aircraft are given.

Notre Numéro du 13e Salon

Published in *L'Aéronautique*, December, 1932, p. 372. [A-1]

This issue of *L'Aéronautique* contains descriptions of the French exhibits at the 13th aircraft show in Paris. While most space is devoted to new developments, models already dealt with in previous numbers are included, if only by brief summaries, for the sake of completeness. In this presentation, the aircraft are grouped into six classes according to usage type, and for each class the individual descriptions are preceded by a summary table of specifications and brief characterizing comments. The descriptions are not a methodical and complete survey but include only the technical essentials and novelties. About 60 pages are taken up by the text and the 200 illustrations.

CHASSIS PARTS

Hydraulic Brakes

By F. G. Parnell. Published in the *Journal of the Institution of Automobile Engineers*, November, 1932, p. 54. [C-1]

The author states the advantages of hydraulic operation for brakes and outlines the practical difficulties that have been overcome since the first practical application of hydraulic brakes to a road vehicle on the Fiat racing cars. Among the difficulties discussed are: (a) leakage of fluid, (b) expansion and contraction of fluid, (c) flexible connections, (d) changes in viscosity of fluid, and (e) corrosion.

The article describes the Lockheed closed-circuit system, the Timken liquid brake, the De Lavaud hydraulic brake system, and in great detail, the Lockheed self-compensating system, together with the application of the vacuum servo units to the Lockheed hydraulic brake system.

The Salerni Power Transmission System

By Piero Salerni. Published in *The Automobile Engineer*, September, 1932, p. 421 [C-1]

Commendatore Salerni gives an outline of his new easy gear change arrangement and in the October issue of *The Automobile Engineer* a more detailed description of the transmission is given.

Servo-Débrayage ou Roue Libre?

By René Charles-Faroux. Published in *La Vie Automobile*, Dec. 25, 1932, p. 639. [C-1]

Of the two methods of rendering easier the operation of an automobile, the vacuum clutch or free wheeling, which is to prevail? After examining this question, the author states as his answer that if economy alone is the desired end, either device may be used with equally good results, but that if facility of gearshifting is the goal, both should be included in the equipment of a motor-vehicle.

ENGINES

Untersuchungen über Traktorenkraftstoffe

By A. W. Schmidt and F. Seeber. Published in *Automobiltechnische Zeitschrift*, Nov. 10, 1932, p. 525. [E-1]

Economic conditions insistently calling for the use of cheaper fuels have, in the opinion of the authors, brought to the foreground the fuel of medium volatility of the grade between the customary automo-

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NOTES AND REVIEWS

Continued

tive-engine fuel and the Diesel fuel. This article is a report of tests on the operating results of such fuels, conducted in the engine-fuel and lubricating-oil laboratory of the Breslau engineering college. The effects on power and specific fuel-consumption of various mixture temperatures, obtained by heating the fuel, the air or both, were ascertained. Octane-number ratings of such fuels were also made and are contrasted with similar data for other types.

Compression-Ignition Engines for Road Vehicles

Compiled by the editor of *The Commercial Motor*. Published by the Temple Press, Ltd., London; second edition, 1932; 153 pp., illustrated. [E-3]

This book deals with the theory and practice of the high-speed compression-ignition engine, describes all makes marketed at present and includes chapters on maintenance, engine auxiliaries, fuel-pumps, fuels and lubricants, with detailed tables of vehicle operating costs. This second edition is up to date, longer and more comprehensive than the first, which appeared in January, 1932.

MATERIAL

Determination of Gum in Gasoline

M. J. Mulligan, Wheeler G. Lovell and T. A. Boyd. Published in *Industrial and Engineering Chemistry*, Analytical Edition, Oct. 15, 1932, p. 351. [G-1]

A simple and rapid method for the determination of the gum content of gasoline is described and is said to approximate in some regards the conditions which exist during the deposition of gum in the intake system of an automobile engine. The procedure is essentially a high-temperature modification of the conventional air jet method. A glass beaker containing the gasoline is held in a well in a constant-temperature bath vessel, containing a liquid boiling at about 200 deg. Cent. Air flowing at the rate of one liter per second and heated in passing through a tube incorporated in the bath vessel is used to evaporate the gasoline and dry the residual gum. The time required to obtain a sample of gum of substantially constant weight from 50 ml. of gasoline is 20 to 25 minutes. According to the authors, oxidation during the determination is not an important source of error, reproducible results are obtained, and difficulties from creeping have not been experienced. Comparative data by this and by other methods are given.

Valve Steels

By J. R. Handforth. Published in *The Automobile Engineer*, October, 1932, p. 468. [G-1]

Experience has shown that the requirements of the ideal valve material are frequently incompatible. The author elaborates on this statement and sets forth some of the metallurgical problems arising from the use of various valve steels in internal combustion engines. Particular attention is given to the effect of long exposure to the high temperatures encountered in aircraft engine service where 1000 hours with merely top overhaul is the desired standard.

To examine the effect of this long period of heat treatment on recognized valve steels, seven well-known steels were selected for experiment. Test methods are described and results for each specimen given in detail. The author states that these tests show clearly that all the steels under examination undergo some definite change by the 1000-hour heat-treatment at the running temperatures of aircraft engines.

The Fatigue Resistance of Unmachined Forged Steels

By G. A. Hankins and M. L. Becker. Published in *Engineering*, Sept. 30, 1932, p. 402. [G-1]

The investigation described in this paper was carried out at the National Physical Laboratory as part of the work on the effect of surface conditions on the fatigue resistance of steels. In previous papers by the authors and others it has been shown that the fatigue resistance of spring steels is profoundly influenced by the condition of the surface of the material. The present investigation was carried out with the main object of determining the fatigue resistance of certain representative steels when tested in the condition in which they are often used in service, namely, as unmachined heat-treated forgings, and to compare these values with endurance fatigue limits obtained in the same manner on similar test-pieces which had been machined and polished.

Chief among the conclusions is the indication that the effect of the "as forged and heat-treated" surface on the fatigue strength of forgings is not very marked for mild steel, but is of very definite importance in the case of steels which are heat-treated to give a high tensile strength. It is evident that, in order to use quenched and tempered forgings to the best advantage, it is very necessary for them to be machined and polished when high resistance to fatigue is required.

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NOTES AND REVIEWS

Concluded

Über die Einwirkung von Alkolhaltigen Treibstoffen auf Aluminium und Aluminiumlegierungen

By O. Bauer and G. Schikorr. Published in *Automobiltechnische Zeitschrift,* Dec. 25, 1932, p. 583. [G-1]

Since the prohibition against fuel blends of high alcoholic content has been removed in Germany, the government committee on liquid fuels ordered the investigation here reported on the corrosion resistance of aluminum alloys to such fuels.

The government materials testing laboratory carried out the investigation in conjunction with the Kaiser-Wilhelm institute for metals research. Four aluminum alloys and 10 commercial fuels varying in alcoholic content from 10 to 20 per cent were included in the program of tests.

The conclusion reached was that such alcohol blends would not tend to weaken the strength of aluminum alloys by corrosion and that hence such alloys could continue to be used for fuel tanks and fuel feeding parts.

Oil Quenching of Steel

By E. C. J. Marsh and E. Mills. Published in *Aircraft Engineering,* October, 1932, p. 255. [G-5]

To those who are interested in the manufacture of articles for use in engineering workshops from the chemical standpoint, there is often very little sound practical knowledge to provide a link between their side of the proposition and the actual working requirements involved, the authors contend. The quenching process used in heat-treating shops are cited as part of a very specialized science, thoroughly understood by the metallurgist. However, it is outside the metallurgist's sphere to appreciate the full range of properties and the limitations of the media at his command.

The principles involved in quenching and the numerous desirable properties of the medium are dealt with in a brief manner together with certain important details of manipulation involved.

Good Looking Machine Tools Help in Production, Executives Say

Steel welded fixtures and highly specialized tools are questioned

By V. P. Rumely

Galloway

"When a machine looks well, workmen handle it with the care which a piece of machinery deserves. The extra cost of making the original appearance good is saved in maintenance costs in later months."

MACHINE tool prices couldn't be lowered materially even if considerably less attention were given to appearance and "gadgets," in the opinion of a representative group of automotive production men and machine tool executives who have commented recently on the article by J. E. Padgett, Spicer Mfg. Co. vice-president, which appeared in the February issue of the S.A.E. JOURNAL.

Buyers in general wouldn't stand for unfinished looking machines anyhow, most of the commentators think, several of the manufacturing executives expressing particularly vigorous opinions on this particular subject.

Considerable skepticism is evident within this representative group regarding the efficacy of the steel welded fixtures for which Mr. Padgett claimed considerable merit, while many agree and a few take issue with his criticism that "highly special multiple spindle equipment is like the investment type of banking, making large profits in boom times but becoming badly frozen and highly expensive in times of low production or rapid change. The high-production multiple-tool machine seldom saves anything."

Analysis of this survey of opinion on machine tool design and selling practices reveals the interesting fact that a number of the machine tool makers seem to agree heartily with some of the criticisms which Mr. Padgett made, while certain of

Galloway

SAYS

a production executive—

"I do not approve of sending tools to the foreman without drawings, giving him only a rough sketch. Money saved in changing the fixture probably would be lost later trying to find out what had been done with it."

his fellow production executives who replied tend to defend the machine tool builder.

"We in the manufacturing end," Mr. Padgett said in his original paper, "should not demand unnecessary work or weight for the sake of appearance, and in this way the machine tool builder can save cost." In discussion at the Annual Meeting he re-emphasized and amplified his opinion that greater simplicity in tools should result in considerably lower prices.

The production chief of one of the largest of the unit parts manufacturing companies who "does not approve of a number of the remarks made by Mr. Padgett," has this to say, for example, on the matter of appearance:

"The expense of painting and beautifying a machine is so slight that eliminating the labor involved therein would not materially reduce the price.

"Furthermore, I am a believer in making a machine look like a machine—not like a piece of ordinary cast iron. When a machine looks well, workmen handle it with the care which a piece of machinery deserves. The extra cost of making the original appearance good is saved in maintenance costs in later months."

This point of view is supported by the comment of the production engineer of one of the most successful car manufacturing organizations when he says:

Beauty Influences Production

"We see beauty in a painting when it is true to nature, but to a mechanic a machine is beautiful only when the proportions of its many component parts look to him to be correct. The mechanic's ability to judge such correct apportionment of parts, moreover, is dependent on the number of years through which he has sweat blood due to the dire results of incorrect proportioning, which include sagging, warping, springing, breakage, overhang, backlash, vibration, chatter, misalignment, burnt out motors, frozen bearings, undue wear and a few others.

"Due to such experiences, the seasoned mechanic subconsciously warms up to a piece of machinery because its correct design looks beautiful to him, even though he is unable to analyze the reasons for its attractiveness."

IN the February, 1933, issue of the S.A.E. JOURNAL, J. E. Padgett, vigorous-thinking and frank-speaking vice-president in charge of manufacturing, Spicer Mfg. Co., wrote, under the innocent title, "Some Principles of Low-Cost Tooling," one of the most thought-provoking critiques on current tool design and price published in recent years.

"There is no question but that his conclusions have created more arguments than the National Debt," an important passenger car production executive told the JOURNAL 30 days later.

Many diverse arguments came to the JOURNAL office in written form. They were turned over for interpretation and analysis to Vincent Rumely, widely recognized as one of the most experienced and competent production executives in the industry.

In the accompanying forcefully written article, Mr. Rumely, who was chairman of the Annual Meeting session at which Mr. Padgett presented his paper—gives his first hand impressions of the results of the argument and of its present status.

The machine tool builders' attitude on this particular subject is pretty well summed up in the statement from one member of that group who says: "When a concern buys a machine tool from a reputable builder it expects certain things. In the first place, it expects the tool to be good looking and easy to handle. The tools which Mr. Padgett described in his article had all sorts of sharp corners and were not at all finished. The average machine tool buyer simply wouldn't accept such finish and design in tools purchased from a regular machine tool maker."

This attitude of the machine builder is justified in the light of past demands from the buyers.

Operators, on the other hand, are probably least concerned about appearances. It is laudable to provide the workman with ideal surroundings, but should we not sacrifice some of the art and thereby temper our expenditures in proporton to the volume and quality involved?

On the matter of machine tool prices, the comments were numerous and frequently referred to new models and special equipment as factors in price.

"No doubt there are quite a few prospective buyers of motor cars," a car production executive says, "who crab about model changes and about the addition of devices to facilitate and improve performance. But they are in the minority, and these engineering improvements create many more sales than they lose. It is my experience that the same sales appeal is applicable to machine tools. The buyers of these machines are just as human as the automobile buyers, although no doubt they may appear at times to the hopeful, hard-working machinery salesman as being entirely devoid of heart or understanding."

Automobile sales managers do contend, of course, that new devices appeal to the car buying public giving many the impression that last year's model is obsolete, but has this not been overdone in many cases? In addition don't we today have some devices upon cars that not alone add cost but are hazardous? Should not the machine tool man study these successes and failures?

Tool Prices Are Lower

A machine tool executive points out that "any list of quotations obtained today will prove that machine tool prices already have been reduced," while another, seeing relatively small chance for reductions through the items which Mr. Padgett suggested, insists that Mr. Padgett "believes the machine tool industry could accomplish much by lower prices, but does not explain very satisfactorily how this could be done."

Backing up his contention, this latter executive states:

"Machine tools are not manufactured in the sense that we think of the manufacture of other kinds of products. They are built in relatively small quantities, and for the most part, machine tool builders must so conduct their business that they can furnish a variety of sizes and models to a narrow technical field distributed over a wide geographical area. In most cases this involves carrying huge inventories as compared with the size of the business, and a relatively slow turnover.

"Over a long period of years the annual return on machine tool capital has approximated 5 per cent. In such a situation, machine tool builders not only see no opportunity to lower selling prices, but feel that, if an industry vital to the country is to be maintained at all, a gradually increasing scale of prices will be necessary.

"Much could be said, however," this executive adds, "with regard to the splendid suggestion of Mr. Padgett has made with reference to the cost of tooling and fixtures."

Another machine tool maker points out that "the purchaser would benefit little from lower machine tool prices, because price and service are very closely connected in the machine tool business. If the machine tool builder were forced to lower prices to the extent that he would be unable to render engineering service to the industries which he serves, those industries would, in a short time, find that they were paying for the same service in another form."

Engineering Service Charges

An important automotive production man has this to say: "We believe machine tool makers should charge for engineering service only after the machine has been proved out the first time on production work. . . . It behooves the machine tool builder to see that the machine is started off properly and will produce as specified. . . . Regarding major reductions in machine tool prices, that is almost out of the question, as tool builders have no volume in building machinery and building in small lots is what costs money. Personally, I do not see that machine tool prices are out of line with most other things which we buy."

Price reductions are closely allied to the "war on waste" which directly touches upon excessive *free service*. The purchaser of tools who complains about high cost frequently is contributing directly thereto, in that his demand for free engi-

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"Welded fixtures and tools can be made up at considerable saving in cost," states one tool builder, "and are being built by automotive manufacturers themselves in their own tool rooms and job shops, but there is serious question as to whether such fixtures would be accepted as satisfactory performance on the part of a machine tool builder."

neering advice and service commonly far exceeds the bounds of reason. Efforts of some to charge for such service have not met with a hearty response. That the seller must be paid some way for such service is beyond question. His efforts to allocate it directly in proportion to amount rendered instead of through an average charge spread over each machine deserves support from all quarters.

Mr. Padgett's remarks about steel welded fixtures brought a greater volume of comment than any other single phase of his article. The vice-president of manufacturing of an important heavy-duty truck company confines almost his entire attention to this point in a letter of comment.

"I was much interested," he writes, "in the remarks on steel welded fixtures. No doubt, as Mr. Padgett suggests, considerable time may be saved in development, but there is a question in my mind as to the saving in cost on the more complicated type of fixture.

"Some time ago we had occasion to check this, submitting a design of a fairly large and rather complicated fixture. One of the firms bid on an all-welded type of fixture and others bid on the cast type. To my surprise, the firm bidding on the welded type submitted the highest of four bids.

"In the rapidity of building up these welded fixtures, no mention is made of normalizing after welding and before machining, which is part of the procedure on cast fixtures. I would think this operation would be necessary on account of the various strains set up in the unit as a result of welding."

A machine tool builder, discussing this same question, points out that elimination or absorption of vibration is vital in machine tool design. "In some designs," he says, "mass or weight is absolutely essential if a successful product is to be obtained. Welded sections do not meet the requirements of mass, and furthermore, it is questionable if welded sections are in the long run cheaper than castings. A simple fixture could, in some cases, be made cheaper by welding sections together, but a complicated fixture certainly would not.

"It is very doubtful if any manufacturer of precision machinery would agree with Mr. Padgett's use of welded sections; not because of any prejudice, but because experience has shown that to put mass where it is needed, the pattern and foundry are the less costly in the end."

Welded Fixtures Questioned

Another tool maker has this to say about welded fixtures:

"Welded fixtures and tools can be made up at a considerable saving in cost and are being built by automotive manufacturers themselves in their own tool rooms and in tool job shops, but there is serious question in our mind as to whether such fixtures would be accepted as satisfactory performance on the part of the machine tool builder."

From the above comments, one concludes there are limitations to welded fixture application. Mass in some cases is cited as an important factor. Experimentation by the user will develop the initial possibilities for his particular field quicker than by asking the outside designer or fixture manufacturer to pioneer for him. Prejudice and sales resistance would thereby be overcome and the applications would broaden with experience.

Among other interesting comments made by various production and machine tool men on Mr. Padgett's article was the following:

"I don't approve of a number of Mr. Padgett's remarks,

J. E. Padgett

IN his original paper, on which the accompanying analysis and interpretations are based, Mr. Padgett predicted that the demand for changes in automotive products and the substitution of new devices would increase in the next few years.

Stating the major factors with which managements are concerned at present, he mentioned that, after direct labor costs, the next largest items of expense in a machine shop are generally depreciation and obsolescence of machine fixtures and tools, especially when a plant is tooled for high production.

He stated his belief that the machine-tool industry might aid by reducing its prices and that this could be done, but that in such case the industry must eliminate its present cast-iron or cumbersome type of designing and many of its present manufacturing methods.

General machine-shop practice was analyzed and three classes of fixtures were discussed: (1) holding, (2) self-contained tools with holding means and (3) complete mechanisms. These show a new technique, he pointed out, in obtaining fixtures cheaply, quickly and of such construction as to be capable of easy, rapid change. They illustrated the use of welded steel instead of cast iron.

V. P. Rumely

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such as the ones about sending tools to the tool room and telling the foreman what to do without drawings, giving him only a rough sketch. . . . If the fixture happens to be one for line production, that idea would be perfectly all right, making changes without drawings or records of changes, but in a vast majority of companies, this could not be done economically. The money saved in changing the fixture probably would be lost in later months trying to find out what had been done with these fixtures."

Much can be said in favor of an orderly reference record for tool design. But is it not also true that we have permitted our drawings and records to become cumbersome, complicated, theoretical and consequently too expensive? Has every one given study to the frequency of reference to the thousands of tool drawings found in automotive plants? Has a distinction been made between perishable and non-perishable items and have drawings been curtailed accordingly?

One machine tool man, while admitting that tool prices might be lower, points out that the average buyer won't put up with crudities in design in tools bought from machine tool builders which he might easily tolerate in units built by himself and that the average tool buyer does want more service and engineering help than Mr. Padgett seems to demand.

One production man offers this idea to machine tool makers: "I am sure that any machine tool manufacturer who can offer an adjustable center machine having the same rigidity as obtained by fixed center spindles, which will operate at the same feeds and speeds, and producing a like accuracy will have no trouble getting a welcome audience from any car builder whenever equipment of this kind is to be purchased."

Study of these comments on Mr. Padgett's paper brings to mind other factors of real importance in solving modern manufacturing problems.

Reductions Desired

Greater flexibility of machine and tooling equipment is the constant cry of car designing engineers and many plant and manufacturing executives. Reductions are desired in the following:

(1) Costs for new models and engineering changes

(2) Time required to place changes in production

(3) Amount of material run ahead to permit reworking former tool, die or machine for mid-season changes

(4) Hazard involved in sales department estimates of sales 3 to 6 months in advance of season's end for new model changes also involving reworking tools and equipment.

New tool and machine costs must be justified by the effect upon labor costs based upon a conservative schedule estimate. Due consideration must be given to the probability of new design appearing in 6 months or a year and seldom can we be assured of a part continuing for 2 or 3 years.

A typical example of error was cited at the Annual Meeting where an excellent power rivetting fixture was to cost $800. When presented for O.K., checking of the season's schedule revealed a plan to build a total of 200 jobs. The extra labor cost if rivetted by hand would be .05 per job or $10 for the season. In this case the fixture would have cost 80 times the total extra hand labor for one season.

Another case of high cost for dies was reported. A die charge of $300,000 was spread over a year's production of 2000 bodies, averaging $150 each. Naturally the extra was reflected in the car selling price at a higher figure to allow for dealer and car manufacturer's profit. A decided sales resistance due to this extra was evident throughout the season, notwithstanding the high quality of the product.

The fixture, tool and machine manufacturing industries should study prices thoroughly to ascertain all factors constituting them with a view to eliminating every unessential element. Business recovery and at least a fair volume demand are, of course, a prerequisite to profitable support for price concessions. Industry in general can profit by the rather startling report recently turned in by the National Transportation Committee which in substance recommended an elimination of unessentials instead of increasing rates. From the various letters and comments of the machine and tool industry there is apparent a willingness to effect cost reductions. Mr. Padgett's paper has contributed much toward bringing into the open the desires of the buyer and seller and without doubt will result in more constructive concessions and understandings between them.

One Accident in 4,377,425 Miles

AMERICAN-OPERATED scheduled air lines flew 4,377,425 miles for each fatal accident occurring during the last six months of 1932. Col. Clarence M. Young, assistant Secretary of Commerce for Aeronautics, has announced. Passenger miles flown per passenger fatality (a passenger mile being the equivalent of one passenger flown one mile) were 9,113,672.

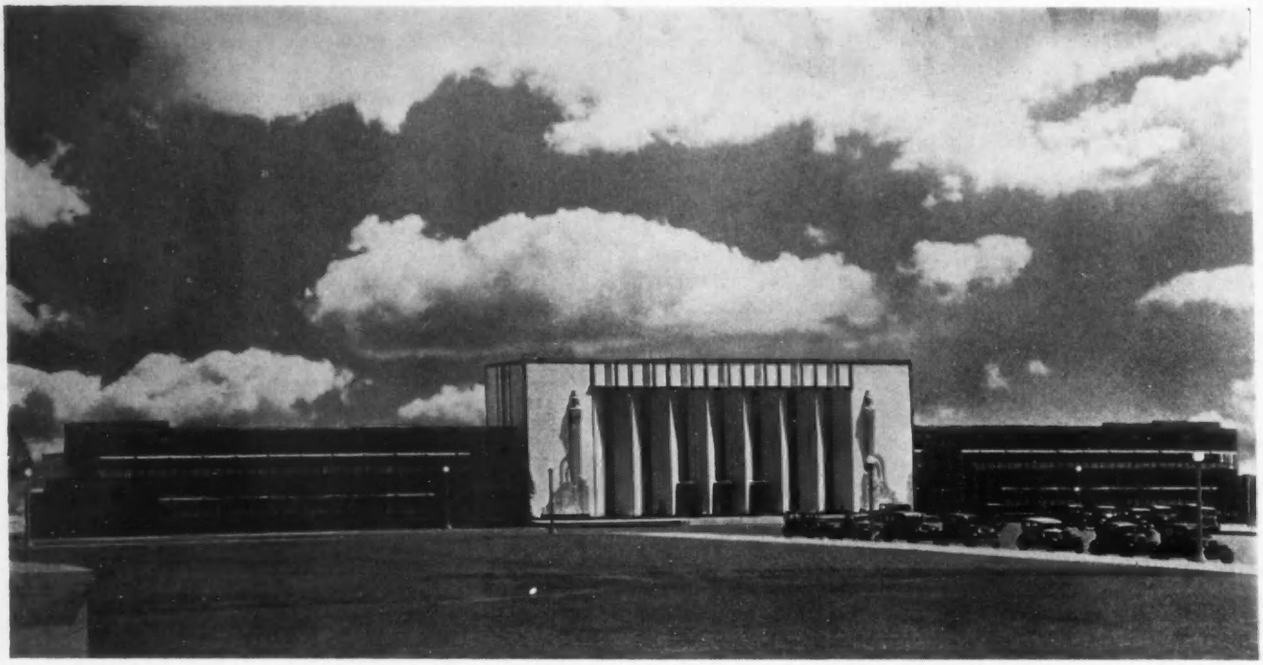
The semi-annual report by the Aeronautics Branch on accidents in scheduled air transportation, from which the foregoing figures were taken, showed also that there were 48 accidents in 26,264,553 miles of flying by scheduled air transport operators during the period July-December, 1932. Miles flown per accident were 547,178. Six accidents involved passenger, pilot or aircraft crew fatalities.

In the last half of 1931 the air lines flew 27,195,062 miles with 65 accidents, including 9 which involved pilot or passenger fatalities. Miles flown per accident in that period were 418,386.

Causes Analyzed

Causes of the 48 accidents occurring during the last half of 1932 were divided as follows: Personnel errors 15.95 per cent; power plant failures 23.41 per cent; airplane failures 24.47 per cent; miscellaneous (this classification including weather, darkness, and airport and terrain) 34.04 per cent. In 2.13 per cent of the accidents the causes were undetermined or doubtful.

In a study of the injuries and fatalities occurring in scheduled air line accidents during the second half of 1932 it was found that 16 persons suffered minor injuries, 8 were severely injured and 18 lost their lives. The latter included 9 passengers, 5 pilots, 2 co-pilots and 2 members of aircraft crews who died in aircraft accidents or as a result of injuries suffered in aircraft accidents. In all, there were 176 persons involved in scheduled air transport accidents, of whom 134 received no injuries whatever. A total of 291,727 passengers was carried during the period.



Administration Building of Century of Progress Exposition

Committees Alive With Plans for Big Chicago Meeting

WHEN the national meetings committee, headed by chairman Alex Taub went into program-planning action way back on March 8, there was started a dynamo of organization effort which will culminate in the big International Automotive Engineering Congress in Chicago, Aug. 28 to Sept. 4.

No sooner had meetings committee approval been granted for this gigantic convention than vice-president J. M. Crawford assembled his passenger car activity committee and went to work to develop a specific program for the three sessions which have been allotted to this group.

Almost simultaneously, F. W. Cederleaf's production activity committee met to begin planning, as did the passenger car body group under R. F. Anderson's leadership and the motorcoach and motor truck committee with M. C. Horine at its head.

Nearly 30 days before public announcement of the Congress was made, in other words, definite moves toward construction of vitalized, dominant programs already were under way.

Since then every activity committee has swung into operation. J. F. Winchester, dynamic leader of the transportation and maintenance group for this year, promises to fill the sessions allotted to his group with papers of unusual power; vice-president Harte Cooke predicts an unusual program on Diesel engines. The speakers on aircraft and aircraft engines will powerfully supplement the attraction of the big air meet which will take place during the Congress, according to vice-presidents C. M. Young and A. V. D. Willgoos. And the newly formed fuels and lubricants activity with A. E. Becker at its head is going to strive vigorously in its maiden effort in arranging a schedule of papers for a national meeting of the Society.

The progress already made by these individual groups indicates certainly that with this huge international affair, held in the midst of the Century of Progress Exposition, the Society will establish a new record among the various important undertakings which have occurred during the 27 eventful years of its life.

As the title of this Congress indicates, it will include not only a wealth of timely technical sessions, but also a full quota of important committee meetings, exhibits, demonstrations and social gatherings which will profit by its distinctly international scope and flavor. Scores of European engineers, bent

on seeing the Century of Progress Exposition, are planning their visits to coincide with this major Society of Automotive Engineers event, while several technicians of world-wide fame will be prominent in the meetings program itself.

Correlation of work already done by the committees indicates that the papers presented on the opening days, Aug. 28 to Aug. 30 inclusive, will cover motor truck and motorcoach design, production, operation and maintenance, and on these same days there will be papers covering broad phases of current problems, together with a session on tractors and one general session which will be international in character.

On Aug. 31 have been scheduled sessions on Diesel engines and their fuels; on the latest developments in passenger car design; and on marine engines.

Aircraft Sessions Scheduled

The technical sessions from Sept. 1 to 4 inclusive, will, for the most part, deal with aircraft and aircraft engine design, construction, operation and maintenance. Meetings of outstanding importance are planned for these last four days, however, on passenger car problems, fuels and lubricants.

On the evening of Thursday, Aug. 31, will be a banquet at which speakers of international fame will speak briefly and pointedly.

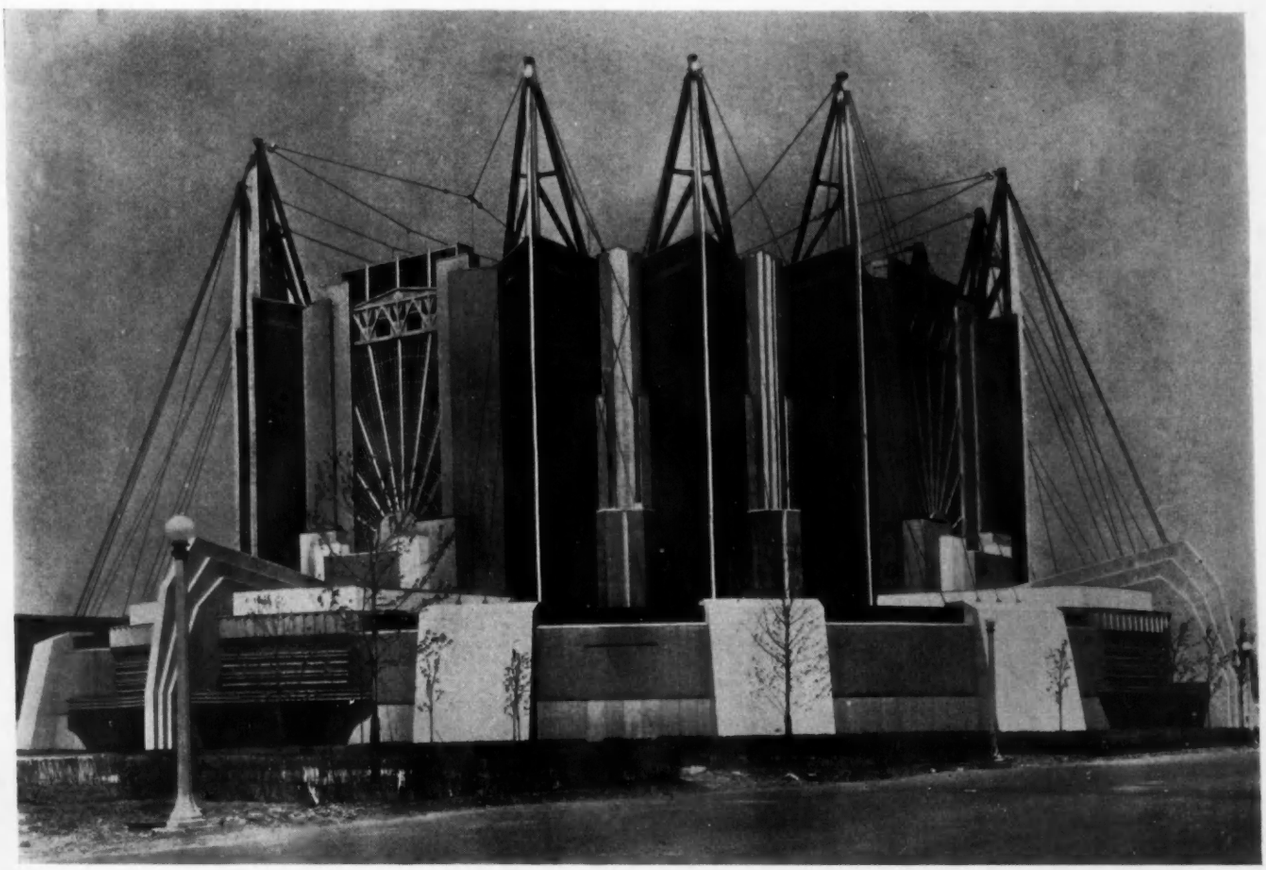
Throughout the meeting, the sessions are being so arranged as to make the afternoons free for visiting the Century of Progress Exposition, in the development of which automotive men and companies are playing a major part.

While the list of exhibitors at the Century of Progress exhibits has not yet been entirely completed as this is written, it is evident that automotive companies will be prominent and that organizations in allied fields will participate in practically every division of the great exposition.

Special Automotive Exhibits

Special buildings have been erected by such outstanding automotive organizations as Chrysler, General Motors and Firestone, while the list of exhibitors contains also such well-known automotive names as Alemite, American La France & Foamite Industries, Inc., Borg-Warner, Cord Corp., Packard, Pan-American Airways, Studebaker, Timken axle, Timken bearing, Waukesha, Link-Belt, and others in fields allied to the automotive industry.

Vincent Bendix, president of the Society in 1931, has been an outstanding figure in the whole development of the Century of Progress movement, and is gaining international acclaim for having lent to the World's Fair the Golden Pavilion of Jehol, called by experts "the Celestial Empire's most precious architectural creation." It was brought to this country by the famous explorer, Dr. Sven Hedin, the realization of whose plans was made possible by funds advanced by Mr. Bendix.



Larger than the dome of St. Peter's or the Washington capitol, this "sky-hung" dome of the Travel and Transport Building strikes a new note in architecture at Chicago's 1933 Century of Progress Exposition

Fitting Transit

By Charles O. Guernsey
Chief Engineer, The J. G. Brill Co.

Galloway

Elevated and subway systems are needed for handling very dense traffic

IN reviewing the present status of the transportation industry and attempting to predict what equipment should be used for future operations, it is necessary to take into account the relative capital cost, gross revenue, track and route mileage, the number of vehicles required and the passengers carried for the different classes of cities, and, indeed, for each different route in each city.

In the smaller communities the investment required for tracks, substations, lines, equipment, etc., to operate trolley car service, is out of all proportion to the revenue received, while in the larger cities, by reason of the greater density of traffic, the continuance of trolley car service on the heavier lines seems to be entirely justified. This is very well indicated by statistics published by the *Transit Journal,* which show that interurban operation and communities under 25,000 population represent 35.8 per cent of the total route mileage and carry only 10.6 per cent of the passengers, with 13.6 per cent of the total revenue. By contrast, the thirteen larger cities operate the same mileage (35.8 per cent), carry 61 per cent of all the passengers, and take in 57.8 per cent of the revenue. In the 80 intermediate cities the situation lies between these two extremes, these cities operating 44.1 per

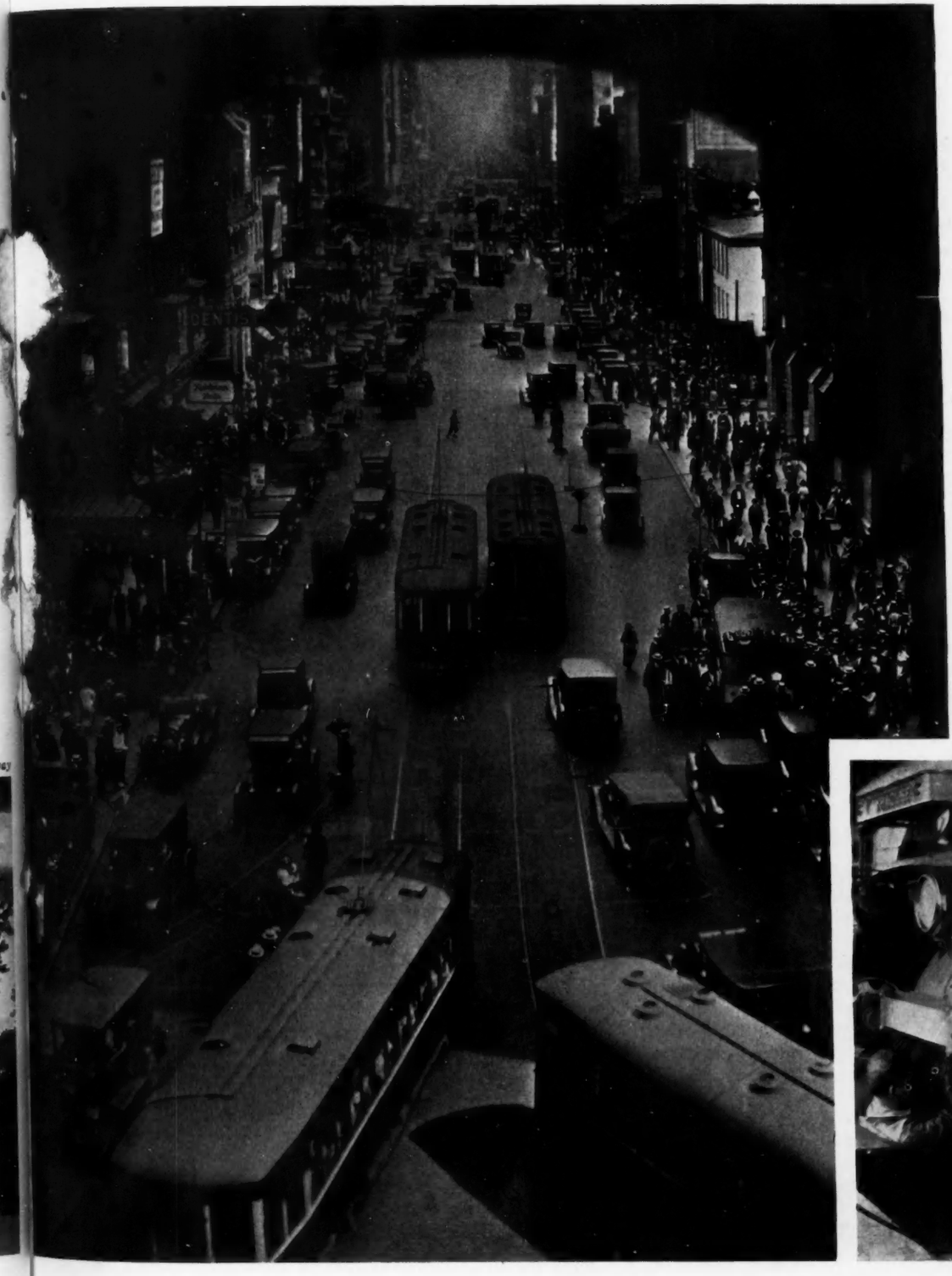
". . . the gas bus should be used in the lightest range of traffic density."

"The trackless trolley belongs in the intermediate range of traffic density . . ."

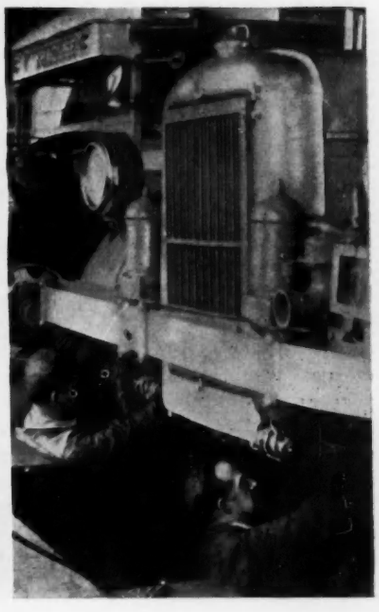
Galloway

"Electric trolley fits in range of heaviest traffic density up to limit justifying subway - elevated systems."

Equipment to Its Best Job



To *Transit Journal* and *Bus Transportation* we give acknowledgment and thanks for the photographs used with this article



Maintenance is an important element in bus operating costs

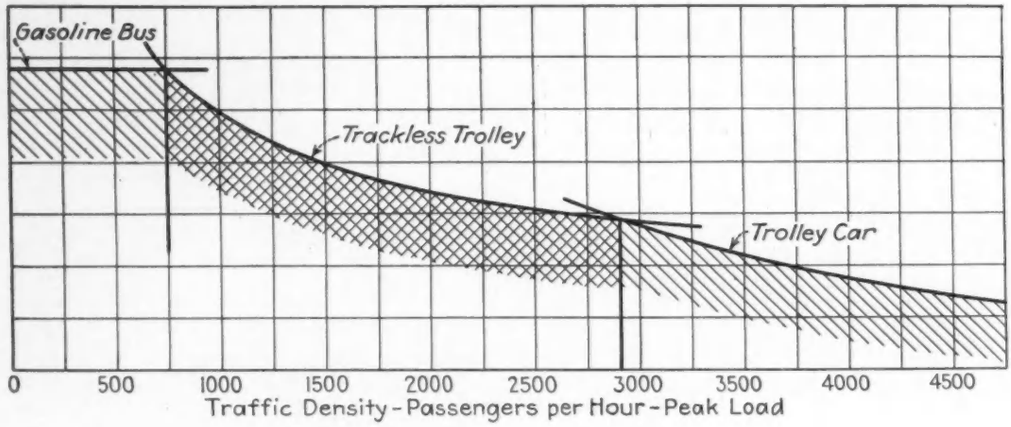


Fig. 1—Type of Vehicle Giving Minimum Cost Per Seat Mile Under Various Traffic Densities. Same Seating Capacity in Each Case

cent of the route mileage, carrying 28.6 per cent of the passengers and taking in 29.9 per cent of the gross revenue.

A general statement which may be deduced from these showings is that in the smaller communities and light traffic lines of larger communities, transportation having low capital cost is important, even at some disadvantage in direct operating cost, while in the more dense communities direct operating cost becomes of primary importance, with the blending off from one to the other through the intermediate zones.

To determine the answer as to best equipment for any given local situation, it is necessary that a definite engineering study be made on the basis of local conditions. We shall attempt, however, to develop general facts applicable to all cases, recognizing that when applied to a specific case the national values, which are the basis of our generalizations, must be modified to fit each specific case.

The vehicles now generally recognized by transit operators as having a place in their scheme of things, include taxicabs, electrified private right-of-way suburban lines, gasoline motor buses, trackless trolley cars, electric surface car lines, and subway and elevated rapid transit lines. It is also recognized that each of these vehicles has certain inherent advantages and certain inherent short-comings, and that no vehicle contains all the desirable elements, and that each of them when applied in its own proper sphere will make a better relative showing than other classes of equipment under the same conditions.

All Interests Considered

In judging the relative desirability of various classes of equipment, there are three (3) distinct groups or interests which must be taken into account, i.e., the operator, the patron and the general public.

It may be stated that in light service a maximum number of comparatively small vehicles, in spite of a comparatively high seat mile cost, should be used to maintain the necessary frequency of service. In the heaviest of traffic, larger capital expense and larger car or train units are justified by the increased revenue available and the lower direct operating cost per seat mile.

It can be inferred from the foregoing that for the lightest of services, because of its lower capital cost, the gasoline bus is preferable; on the heaviest of services, in spite of the tremendous capital cost, subway and elevated systems are justified; on the intermediate services, which form the vast majority of local transit conditions, there is a field in the heavier traffic (which, nevertheless, does not justify subway-elevated construction) for the surface electric car; while in the lighter end, where the relatively high operating cost of the gasoline bus is not justified, the trackless trolley finds its field—these conclusions taking into account operating cost only.

The results which have been obtained in attracting riders by the use of modern equipment of various types, indicates that operating cost per mile or per seat mile should not be given too much consideration in selecting new equipment. If a modern transportation medium will attract 50 per cent more passengers, 10 or 15 per cent higher first cost per mile or per seat mile may be justified. Nevertheless, it is worthwhile to analyze the relative operating costs of the various types of equipment.

Without attempting to show exact values, which as a matter of fact will vary for each application, it can be shown that there is a distinct field each for the gas bus, the trackless trolley, the trolley car, and, in extremely dense traffic, the subway-elevated system. Based on national average costs, and subject to variation in individual cases, the costs would work out somewhat as shown in Fig. 1. For the lighter service, running up to a maximum peak hour density of about 700 passengers, the gasoline bus will be the cheapest. In the range between 700 passengers and 3000 passengers per hr. passing the peak point of the line, the trackless trolley will show the lowest cost. Above 3000 passengers per hr. peak load the trolley car is cheaper than the trackless trolley. Where the dividing point comes between the surface trolley car and the subway-elevated system is so largely determined by local conditions and political considerations, that it is difficult to predict, but is probably in the neighborhood of 40,000 passengers per hr. All of these costs are based on new installation, and include the proper allowances for depreciation, maintenance, amortization, etc.

If existing equipment, such as substations, can be continued without additional expense and if the substitution of other equipment would require the scrapping of such facilities, then the vehicle which would profit by the use of such existing equipment would show an improved comparative cost in proportion to such reduction in new capital expenditures.

Fig. 1 is based on all vehicles being of the same seating capacity.

In considering vehicles of a fixed type, as, for instance, a gasoline bus or a trackless trolley, the operating cost per mile naturally increases with the size of the vehicle. On the contrary, however, the cost per seat mile reduces. This is brought out by Fig. 2.

To achieve the minimum operating cost, therefore, the

largest vehicle consistent with reasonable headway, should be used. However, considering the picture broadly and taking into account the increased revenue which may be attracted by more frequent headway, it is entirely possible that a greater number of smaller vehicles may be required, particularly in lighter service or on short runs, in order to attract passengers, even though the over-all operating cost be higher.

The foregoing may be summarized by saying that when considering *costs alone* there is a distinct field each for gas buses, trackless trolleys, and electric surface cars, and that these fields can be rather definitely predetermined. Other conditions being normal, the gas bus should be used in the lightest range of traffic density, the trackless trolley in the intermediate range and the electric trolley car in the range of heaviest traffic density up to whatever limit may jusify the use of subway-elevated systems.

Determining Size of Unit

Based on the necessity for frequency of service, longer lines will justify larger vehicles with less frequency of service, while shorter lines, because of the frequency of service required, may, of necessity, require the use of smaller units, with higher per seat mile costs. The length of line and other conditions being the same, the smaller vehicle should be used in the lightest traffic density, ranging to the largest feasible equipment in the zones of heaviest traffic.

These conclusions are based solely on the cost of giving transportation under the various specified conditions. This, of course, is a very important point to the operator, but actually the purpose of the operator is to make a return on his investment, and it may very well be, and often is, in fact true, that sometimes the cheapest operation is not the most profitable. In these days of competition with the private automobile, the *quality* of service rendered to the traveling public may determine the amount of riding and, therefore, the profits, so that under some conditions the equipment which has the best rider appeal may turn out to be the most profitable, even at a somewhat higher per mile or per seat mile cost.

"Necessity" Riding

It is true that people do not take short rides for pleasure. Local riding is practically all necessity riding—the handling of people going to and from their places of business, shopping, etc. Nevertheless, the question as to whether a particular rider goes by public transportation or drives his own automobile, may depend very largely upon the character of service offered.

THIS paper is an attempt to view the various types of transportation equipment impartially and to classify them as to their advantages and disadvantages and to indicate in a general way where, in the general scheme of organized local transportation, each of these various agencies fit to best advantage.

IT is an interesting fact that in cities of over 500,000 population, approximately 75 per cent of the travel is by public carrier, although public carrier vehicles represent only about 10 per cent of the street traffic. Taking the country as a whole, more than 65 per cent of all public carrier passengers are carried on surface electric railways, 18 per cent are carried on rapid transit lines, 2 per cent on electrified suburban railroads, 12 per cent on buses, a fraction of 1 per cent on the newly reborn trackless trolley, and 2¾ per cent in taxicabs. In the larger cities approximately 80 per cent of all passengers are carried on surface electric railways.

The Gasoline Bus

1. The gasoline bus can be installed to perform a given service for a lower capital cost than any of the other methods.
2. It has complete mobility of route, which is a considerable advantage in changing or unsettled communities.
3. It can be readily shifted from one operation to another as conditions may require.
4. It is available for special hire service independent of its scheduled or franchise route.
5. Its comparatively low cost permits it to be written off and new equipment purchased at more frequent intervals, thereby keeping a fleet more modern.
6. It satisfies the modern urge to ride on rubber.
7. It permits curb loading and unloading of passengers.
8. Because of the high braking rates which are possible, combined with its maneuverability, its safety in dense traffic is comparatively good.

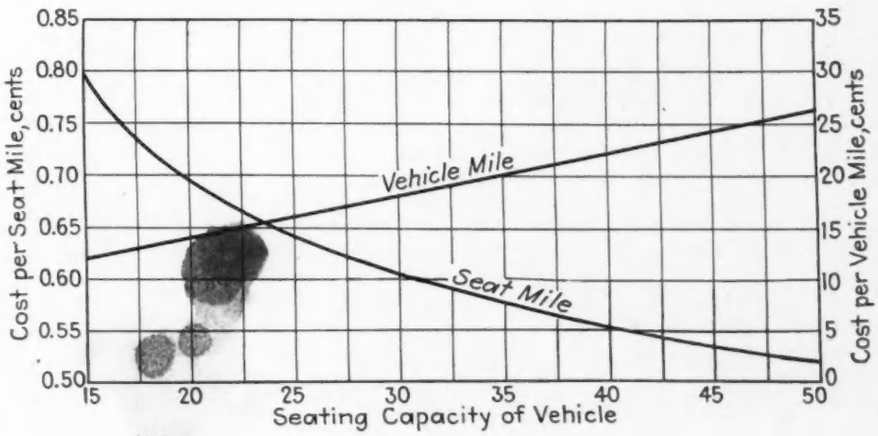


Fig. 2—Relative Costs—Same Type of Vehicle and Same Operating Conditions

The motor bus slate is not entirely clear, however. It has certain inherent objections, some of which will undoubtedly be eliminated, or at least moderated, under future development:—

1. Its complete mobility may be an actual handicap in settled communities where real estate values, business house locations and other important factors in the development of community life depend upon permanence of public transportation routes. The ability to shift bus routes tends to keep community developments in a state of flux.

2. The power, i.e. gasoline and oil, costs are higher than for the other equipments under consideration.

3. The maintenance costs are higher.

4. The vehicle must be shopped for repairs at more frequent intervals and, therefore, cannot perform as high a percentage of scheduled mileage.

5. The jerking, grinding and jarring incident to the operation of the clutch and gearshift, and operation in the lower gears, is unpleasant and detrimental to the vehicle. The alternative of gas-electric operation, while eliminating these objections, introduces those of higher weight, higher first cost and possibly higher fuel costs.

6. Fatigue to operator.

7. By reason of the necessity of holding weights to the minimum, the life of the vehicle and its component parts, is considerably less than competing vehicles. To illustrate this point, compare the life of the electric traction motor to the gasoline engine; electric car gearing to the bus transmission; the light weight, high duty air brake equipment, particularly the compressor, with corresponding elements in cars; also automotive type lighting fixtures, etc., with the more substantial high voltage equipment.

8. Since the motor bus must carry its own power house, it has not been expedient, up to this time at least, to carry a high power factor which will permit of rapid acceleration. The result is that in frequent stop service the schedule speed must be lower than for competing vehicles under the same service conditions. Under the present trend of increasing power and reducing weight, there will be some tendency to offset this differential, but at the expense of a still further increase in first cost and the cost for fuel and maintenance.

9. While progress has been made, the bus is still a serious offender from the standpoint of exhaust fumes both inside and outside the vehicle, as evidenced by the numerous papers on methods for overcoming these troubles.

10. Since there is no fixed evidence of franchise rights represented by physical property in the streets, there isn't the assurance of permanence of franchise which an operator desires.

11. The reliability in terms of miles per failure is inferior.

12. It has comparatively inadequate lighting and heating.

13. The operating cost may fluctuate widely by reason of changes in price of or tax on fuel.

The Trackless Trolley

The trackless trolley as at present built, is a comparative newcomer, having a history in this country of only about four years. As now built these vehicles are probably more attractive to the general public and car riders than either the gas bus or the trolley car. Among their advantages may be mentioned:

1. Complete silence of operation.

2. Rapid accelerating and braking ability (limited only by the capacity of the passengers to stand such accelerations and decelerations).

3. In view of this acceleration and deceleration, they can perform a higher schedule speed in frequent stop service than any other vehicle, not excepting the private automobile.

4. They can maintain their place in traffic.

5. They permit of curb loading and unloading.

6. As compared to a gas bus, they have better lighting, heating and ventilation.

7. No odors.

8. Exceptionally good riding qualities.

9. By reason of the combination car type structure and good maneuverability, their safety record is superior to both the gas bus and trolley car.

10. Ease of handling. (Operator is required to handle only a steering gear, plus one pedal for acceleration and another for braking. No clutch or gear shifting manipulation is required.)

11. The power cost is lower than for the gas bus.

12. The operating equipment is simple and reliable, requiring a minimum of maintenance and adjustments. (The rotating equipment consists only of a motor armature, propeller shaft, drive axle parts and wheels.)

13. By reason of simplified maintenance, can operate a high percentage of schedule mileage.

14. Within its proper application limits, the operating costs per vehicle mile or per seat mile, is lower.

15. The mobility within its route is superior to the trolley car and only slightly inferior to the gas bus.

16. The presence of overhead lines assures permanency of route at advantage to residents, merchants and property owners.

17. Operates satisfactorily under unfavorable weather conditions.

18. It can be maintained by regular car barn crews.

19. Complete absence of vibration makes for a pleasant ride and longer life of the equipment.

20. Its life is greater than the motor bus and it can be depreciated at a lower rate.

21. Quality of service does not drop unduly with age.

Trackless Trolley Disadvantages

Some of the disadvantages of the trackless trolley are:

1. As compared to the trolley car, the direct operating expense per seat mile is higher. (The over-all expense, depending upon density of traffic, may be higher or lower.)

2. It is limited to a range of about 15 ft. either side of the overhead line.

3. As compared to the gas bus, the initial cost is higher because of the capital cost involved in line and substations.

4. It is not adaptable to use except on fixed routes where a satisfactory minimum traffic density has been established (because of the cost of changing overhead lines).

5. On boulevards or residential streets objection is sometimes raised because of the appearance of the overhead lines. Trolley bus routes should preferably be operated on business streets, rather than residential. It should be noted in this connection that where properly constructed, the overhead line can be arranged so that this point is not particularly serious.) [illegible] the car barn is not on the line of operation, a [illegible] constructed to the car barn.

[illegible] limited, so far as single deck operation is con-

(Continued on page 33)

Chronicle *and* Comment

By
Norman G. Shidle

EFFICACY of the fear type of propaganda in any kind of safety work always is open to some doubt. In the case of automobile safety efforts, it frequently does a grave injustice to manufacturers of motor vehicles. Despite the continuance of propaganda questioning the mechanical safety of the average motor vehicle, authoritative statistical data still are lacking to indicate that mechanical failures are responsible for any appreciable proportion of accidents.

The National Safety Council only last year, in fact, completed a comprehensive survey of safety which embraced the entire field of the American motor car in which Tom A. Burke, author of the report covering this analysis, quotes W. H. Cameron, managing director of the Council, as follows:

"After all, the human machinery has fallen down, rather than the autos. . . . We found that physical and mechanical causes, at the outside, cause a very small percentage of accidents. We found that the personal element was the really big factor. Nevertheless, the car manufacturers keep plugging away for greater safety."

ALL of which recalls to our mind what John Warner told the radio audience last fall when he talked on automobile safety from WTIC at Hartford. "In the solution of our highway problems," he said, "no group is more vitally and actively interested than the vehicle manufacturers themselves. They simply cannot afford *not* to build for safety. How long do you suppose a given manufacturer would continue in business if his product were reputed to be unsafe and if every car from his lines were to advertise a hazard? Of what interest are such attributes as comfort, performance and economy, without safety?

"Obviously, the commercial phases coupled with the humanitarian aspects of the problem lead our manufacturers and engineers to strive toward safety as a paramount issue in car design and construction."

THE Akron disaster, unhappy termination of a great engineering feat, brought to Society members very personal grief in the death of A. F. Masury. "I shall always remember him as the man who never refused any request for assistance or cooperation ever made of him by the Society," one prominent member of the staff remarked immediately after the news of the wreck became public.

Strong, aggressive, competent and courageous — these are the words which come first from the scores of friends who continue to speak of his loss as one of major importance to the Society and to the industry.

INDEPENDENT wheel suspension and rear engined cars have come in for a great deal of conversation and technical analysis in the last year or two. Published papers on both subjects have been numerous and exhaustive and informal discussions among engineers have been equally prevalent.

So far no practical commercial manifestations have materialized in this country. How far this lack of actual appearance is due to technical considerations and how far due to the natural retardation of radically new designs in a period of financial stress only time will tell.

It is our guess that each of these factors has had a part in the holding back of both these developments from the commercial stage. In any case, it is safe to say that engineering interest in them is far from dead and that commercial interest still is definitely within the realm of future possibilities.

HERE'S one for the book, relayed to us by Buffalo Section chairman M. A. Thorne, experimental engineer at Pierce-Arrow. Everybody recalls, of course, that startling streamlined job called the Silver Arrow which this company displayed first at the New York Show this year. It was exhibited at various local shows and finally was exhibited at Roanoke, Va.

One of the visitors to the showroom, W. P. Barnhart, the P-A district representative reports, was a middle-aged woman, apparently intelligent and well educated, who listened attentively to the salesman's explanation of the Silver Arrow story. Naturally, the salesman made quite a point of streamlining.

Finally the woman got inside the car and inspected it carefully. After a few moments, she stuck her head out of the open door to ask the salesman:

"Mr. Salesman, what is the difference between this streamlining you have been talking about and just ordinary lining?"

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between March 10, 1933, and April 10, 1933.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (S M) Service Member; (F M) Foreign Member.

BROWN, L. T. (M) associate professor, mechanical engineering, Iowa State College, Mechanical Engineering Department, Ames, Iowa.

FIPPINGER, DAVID (J) automotive and airplane mechanic, 65 Franklin Place, Totowa Borough, N. J.

HIERHOLZER, FRANK J., Lieut. (S M) United States Army, Field Artillery School, Fort Sill, Okla.

MCLENNAN, DOUGLAS (A) traveling representative, Precision Machine & Foundry, Ltd., Calgary, Alberta, Canada; (mail) 10340—97th Street, Edmonton, Alberta, Canada.

MILNE, ALEXANDER (A) shop foreman, service manager, Regal Motors, Ltd., Rosetown, Saskatchewan, Canada; (mail) Box 544.

NONWEILER, KARL H. (M) lubrication engineer, charge of technical section, lubricating oil sales division, Shell Petroleum Corp., Shell Building, 13th and Locust, St. Louis, Mo.

ROBINSON, JAMES B. (J) research engineer (engine development) International Harvester Co., Fort Wayne, Ind.; (mail) 4828 Montrose Street.

SADEE, ALBERT EDUARD MARIE (F M) transportation engineer, General Motors Continental S. A., Antwerp, Belgium; (mail) 254 Juliana v. Stolberglaan, The Hague, Holland.

SMEJKAL, MILOS, DR. ING. (F M) chief manager, Avia Aircraft Co. Ltd., Prague VIII, 1423 Czechoslovakia.

SMITH, ADAM F. (A) vice-president, R. C. Smith & Son, Ltd., 80 King Street West, Toronto, Ontario, Canada.

SMITH, DONALD A. (J) 7724 Ridge Blvd., Brooklyn, N. Y.

SPIESS, PAUL C. (J) draftsman, Grover Loening Aircraft Co., Roosevelt Field, Garden City, L. I., N. Y.; (mail) 23 Roslyn Road, Mineola, L. I., N. Y.

ZAMBONI, GEORGE A. (A) representative for Washington and Northern Idaho, Sinclair Refining Co. of California, 4410 District Boulevard, Los Angeles; (mail) 1005 East Roy Street, Seattle, Wash.

Applications Received

The applications for membership received between March 15, 1933, and April 15, 1933, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

CHANCE, PAUL G., sales representative, W. M. Chance Valve Co., Detroit.

CURTIS, HARRISON H., instructor, Edmonton Public School Board, Edmonton, Alta., Canada.

FRIEDMAN, DAVID, manager, Seattle Auto Wrecking Co., Seattle, Wash.

FRIES, GEORGE A., aeronautical draftsman, Naval Aircraft Factory, Philadelphia.

FRIIS, R. PETER, instructor, George Scherr & Co., New York City.

HALL, ERNEST A., president, The Hall Mfg. Co., Toledo, Ohio.

HARDY, GEORGE DUDLEY, technical assistant, Trojan Ltd., Croydon, Surrey, England.

HEMPEL, EDWARD H., analyst, General Motors Export Co., New York City.

INTERNATIONAL LUBRICANT CORP., New Orleans, La.

JACOBS, LEO HERMAN, president, American Gear & Parts Co., San Francisco, Calif.

JOHNSTON, E. J., salesman, Shell Petroleum Corp., Detroit.

MCCULLOUGH, CHARLES W., engineer, Gulf Refining Co., New York City.

MORTON, HOWARD M., manager of Canadian Co., Quaker State Oil Refining Co. of Canada, Ltd., Toronto 2, Ont., Canada.

MOXEY, J. G., transportation engineer, Sun Oil Co., Philadelphia, Pa.

PARKER, ROY E., lubricating sales engineer, Gilmore Oil Co., Los Angeles, Calif.

PARTINGTON, EDWARD JOSEPH, 80 Harding Ave., Clifton, N. J.

ROBINSON, P. M., chief of development, The Pennzoil Co., Oil City, Pa.

ROBOTHAM, WILLIAM ARTHUR, assistant to experimental engineer, Rolls-Royce Ltd., Derby, England.

SMALLWOOD, WILLIAM J., traffic superintendent, Taft-Peirce Mfg. Co., Woonsocket, R. I.

TRESILIAN, STEWART S., aero engine design department, Rolls-Royce Ltd., Derby, England.

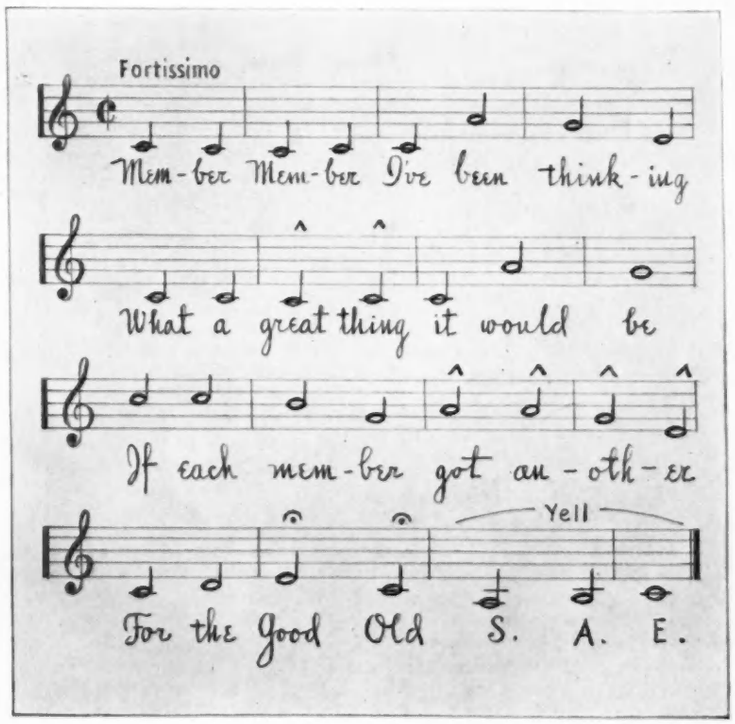
WITTE, FRIEDRICH, reichsbahnrat, German Railroad Co., Berlin, Germany.

WYBORNY, BERTRAND L., manager, petroleum department, The House of Gurney, Inc., Yankton, S. D.

"Now," says Membership Chairman, F. K. Glynn,

"All Together—Let's Sing!"

F. K. Glynn



"NOW that the results of the Get-Your-Man Campaign have been announced," writes "K" Glynn, chairman of the National Membership Committee, "we've got to get started afresh on membership work—1933 model.

"And I'm for starting in with song—even if we end up by having people consent to join in order to stop us from singing any more. If the above ditty were rendered frequently at Section meetings, membership matters would at least be kept constantly in our minds—even if we did get protests from the Song-Writers Union, the copyright owners and the Association of Unemployed Musicians.

"'Times are so hard, there's no use trying to get new members,' a lot of fellows have told me lately.

"That's a lot of hooey, and I can prove it! Honest injun!

"Reason I know is that I went after some new members myself recently—just to see what the possibilities were. I contacted one man personally, one by telephone and still another by mail.

Believe It or Not—

"And what do you suppose happened? Yep, that's right. Three applications are signed and in the hands of the grading committee and this during the banking holiday!

"Probably you'll be saying there's something phoney in that—just a lucky break; that it isn't typical of what can be expected.

"Of course it isn't typical. I'm going to keep on trying and my batting average is going to suffer badly as a result. But I hope to get some more members—and that's the important thing.

"Membership can be increased by hard work and cooperative effort, even in tough times like these. Neither costs money and both have come plentifully from S.A.E. men in the past—and will continue in the future without a doubt.

"If every member will set himself to get just one more member during the next twelve months we will end up the year with a good increase—with an increase in keeping with the fighting spirit and the growing power of the Society and its members.

"So, what do you say, gang? All together let's sing—and let's go!"

What Members Are Doing

Members to Speak at Gear Meeting

Four Society members are scheduled to take active parts in the American Gear Manufacturers Association's annual meeting in Wilkinsburg, Pa., May 4-6.

Ernest Davis

Ernest F. Davis, metallurgist, Warner Gear Co., Muncie, Ind., will address the meeting on "Heat Treatment of Transmission Gears." A member since 1911, Mr. Davis is active in Society work, being a member of the Lubricants Subcommittee (Axle and Transmission Group) of the Research Committee.

Robert S. Drummond, president, National Broach and Machine Co., Detroit, will speak on "Lapping of Gear Teeth." Mr. Drummond has been a Society member since 1911 and is on the Production Activity Committee, on which he is serving this year for the first time.

R. S. Drummond

Harry H. Kerr, president, Boston Gear Works, Inc., and also a member of the Society since 1911, is scheduled to supervise departmental sessions which are planned as a special feature of the meeting.

Edward Whiting Miller, chemical engineer, Fellows Gear Shaper Co., Springfield, Vt., and president of the A.G.M.A., will preside. Mr. Miller joined the Society in 1916.

R. W. Wilson has been appointed sales manager, Perfex Corp., Milwaukee, manufacturers of automotive radiators and heavy duty types for the industrial trade. Mr. Wilson, a Society member since 1920, has been with Perfex Corp. in sales and engineering work for the last six years.

James Hartness, formerly president of the Jones & Lamson Machine Co., has retired.

M. Gould Beard has been transferred from the post of air line inspector for the American Airways, Inc., New York, to that of pilot at the Memphis, Tenn., municipal airport.

G. Herbert Miller resigned as sales representative with Collins and Aikman, Farnham, Can., and is now in charge of operations of N. R. Miller & Co., Toronto.

Walter M. Hartung recently assumed the duties of engineering instructor at the Casey Jones School of Aeronautics, Newark, N. J. Previously he was dean of aviation, Beckley College, Harrisburg, Pa.

C. E. Records, former sales engineer with the Layne Ohio Co., Columbus, Ohio, is now head of his own company, also of Columbus, which manufactures well screens.

Newton A. Freed is manager-owner of the Point Pleasant (Pa.) Garage. He previously was sales engineer, International Motor Co., New York, manufacturers of rail cars and locomotives.

C. M. Bouis, formerly salesman, White Co., Chicago, is now with Chrysler Motors-Fargo Division, New York.

Paul S. Bigby is now with the Phillips Petroleum Co., Bartlesville, Okla., having resigned his position as assistant automotive engineer, Universal Oil Products Co., Riverside, Ill.

William T. Livermore, formerly engineer, automotive and labor saving equipment, American Telephone and Telegraph Co., New York, is working on automotive development with the New York Shipbuilding Co., Camden, N. J.

Cyril Albert Wallace-Pitt is a consulting engineer with C. Wallace Pitt & Partner, Toronto, Can.

Ernest A. Hauser, since 1922 chief chemist of the Colluid-Chemicals Laboratory, Metallgesellschaft, A. G., Frankfurt/Main, Germany, recently resigned to become chief chemist, Semperit, Austrian-American Rubberworks, Vienna, Austria.

Robert J. De Roza recently gave up his position as sales representative for the Sterling Motor Truck Co. of California, San Francisco, to become salesman for The White Co., San Francisco.

George W. Yanss, formerly chief engineer, Auto Division and sales representative, Bridgeport Brass Co., Detroit, has resigned and is now assistant chief engineer, Dunbar-Gibson Co., Inc., New York City.

Fred J. Rode is now chief engineer and production manager for the Toledo Machine Tool Co. and Marquette Tool & Mfg. Co., Toledo, Ohio. Mr. Rode formerly was with the E. N. Bliss Co., Chicago.

A. H. Chenault of the Ethyl Gasoline Corp. recently was transferred to the corporation's Los Angeles office from Detroit where he was in charge of road tests department.

W. S. Pritchard has been appointed superintendent of the Gairing Tool Co., Detroit. Previously he was chief inspector, Bundy Tubing Co., Detroit.

Ralph E. Flanders recently became president of Jones & Lamson Machine Co. with which he has been associated since 1914. Mr. Flanders is a member of the National Screw Thread Commission and the American Engineering Council and has served as a vice-president of the National Machine Tool Builders Association.

Ralph E. Flanders

Yoshio Ogawa has resumed his business as owner-manager and consulting engineer of the International Engineering Exchange, Los Angeles. He also represents the Kogyo Shimbun (Industrial Daily News) published at Nakanoshima, Osaka, Japan.

Frank B. Willis recently was made vice-president in charge of sales for the Bendix Products Corp., South Bend, Ind. Previously he held the post of general sales manager, Bragg Kliesrath Corp., South Bend.

Ralph A. Vail, until recently in charge of production, Rockne Motors Corp., Detroit, has been transferred to South Bend, Ind., as factory manager. Mr. Vail has been a member of the Society for the past 23 years.

Roy E. Cole, chief engineer, Rockne Motors Corp., continues in his same capacity, but has transferred his headquarters to South Bend.

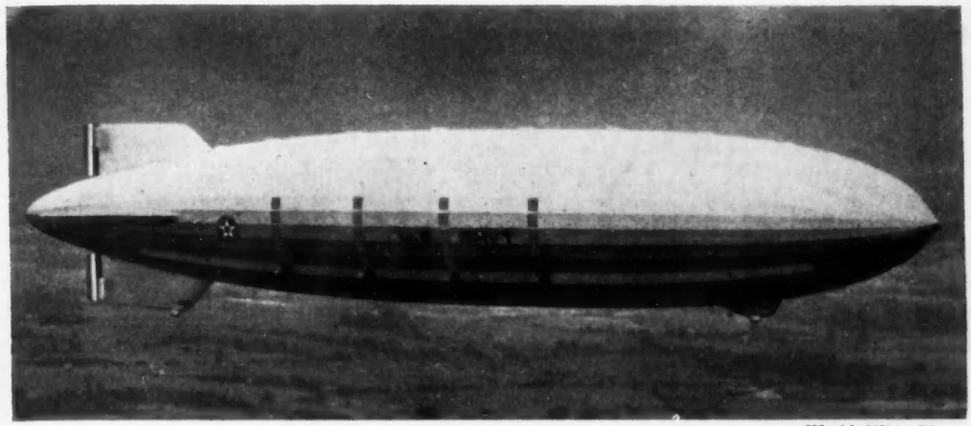
John David Nisley is a layout draftsman for the Northrop Corp. at Los Angeles Municipal Airport. The corporation manufactures all metal airplanes. Formerly Mr. Nisley was the chief draftsman in charge of forging die design, Ingersoll Steel Disc Co., division of Borg-Warner Corp., Chicago.

Arvid C. Olson has been re-employed as assistant service manager by the Johnson Motor Co., Waukegan, Ill.

Edward Spurr has completed his contract with Raymond Mays, Bourne, Lincolnshire, England, as experimental designer and has become engine designer for the British Power Boat Co., Southampton, England. The company designed and built the Miss England series of racing boats. Mr. Spurr will be working on the installation of the Napier engines in the new boat, Miss Britain, and probably will visit Detroit with Mr. Scoti-Paine next September in preparation for his racing program.

Clarence D. Chamberlin, formerly president Chamberlin Aircraft Corp., Jersey City, N. J., is now president Chamberlin, Holmes & Co., Inc., New York City.

S.A.E. Linked to U. S. S. Akron Throughout Its Life



World Wide Photos

Colonel Masury

Members Play Prominent Parts in Big Ship's Brief Career

WHEN, more than 20 months ago, the world's largest airship was christened by Mrs. Herbert Hoover the ZRS-4, to become better known as the U.S.S. Akron, the S.A.E. JOURNAL commented:

"Although the ship will be used in connection with Naval operations, the lessons that are to be learned from its behavior will be of tremendous value in the construction of aircraft for commercial enterprise."

And even in her last losing battle with the elements, the Akron probably recorded many details of the conflict to guide those destined to carry on the conquest of the air. Representing the greatest achievement in airship construction to date, the Akron's brief history has re-emphasized the fact that even yet man is only a pioneer in the realm of flight.

The Society has definitely been concerned with the history of the Akron, not only because of its professional interest in the automotive engineering principles involved, but also because Society members have been closely identified with the Akron since its beginning. Names of prominent members of the Society, Litchfield—Arnstein—Hunsaker—Masury, are written in the brief history of the big ship from the first to the closing chapter.

When the Akron was launched on August 8, 1931, at Akron, Ohio, and some 100,000 persons watched the 221,000-lb. ship float skyward, felicitations were extended to the well-known and other members of the Society who were partly responsible for its successful completion. Paul W. Litchfield, a member of the Society since 1911 and president of the Goodyear Tire & Rubber Co., Dr. Karl Arnstein, a more recent member and vice-president in charge of engineering, Goodyear-Zeppelin Corp., and James Clarke Hunsaker, member since 1927 and vice-president of the Goodyear-Zeppelin Corp., were the most prominent recipients of the Society's congratulations which were extended on the occasion by the then president, Arthur J. Scaife and General Manager John A. C. Warner who were official guests at the christening.

In May, 1932, the Southern California Section sought to arrange an inspection tour of the Akron when the big ship was scheduled for a trip to the Pacific Coast. The Section, however, was advised at that time by Rear-Admiral William A. Moffett that the Akron would be on a strictly Naval voyage in making the trip to the coast and therefore no inspection would be permitted. The Admiral stated, however, that an inspection by the Section could be arranged when the Akron would again visit Southern California, probably in the spring of 1933.

Several months ago when the Section again took up the matter it was advised by Admiral Moffett that there was scant prospect at that time (Feb. 20) that the Akron would be in the vicinity of Los Angeles in the near future. He pointed out that the U.S.S. Macon, sister ship to the U.S.S. Akron, will in all probability be based at the Sunnyvale (Calif.) Naval Air Station after about June 1 and that the members of the Southern California Section could avail themselves of the opportunity to make an inspection of the ship.

The Metropolitan Section likewise had planned to inspect the Akron in connection with a summer meeting which the section expects to hold late in June at Spring Lake, N. J.

When the U.S.S. Akron failed to survive the onslaught of the elements which beset her in the last flight on the night of April 3, one of the most active members of the S.A.E. was on board as an invited guest—Col. Alfred Fellows Masury.

On behalf of members of the Society, President A. C. Dickinson in a wire to Secretary of the Navy Swanson, April 5, conveyed the Society's regret for the destruction of the Akron and deep sympathy for the loss of officers and men, including fellow-member Col. Masury.

Alfred Fellows Masury

Col. Alfred Fellows Masury lost his life in the ill-fated Akron on April 4. He had been exceptionally active in Society affairs having become a member in 1908.

At the time of his death Col. Masury was vice-president and chief engineer International Motor Co., Mack Trucks, Inc., New York City, having been associated with the International company since 1913 when he became manager, general sales department. In 1915 he became chief engineer, and from 1920-1931 he was vice-president and chief engineer.

Prior to his connection with the International Motor Co. in 1913, Col. Masury was with American Coulthard Trucks, and in 1910 he joined the Hewitt Motor Co., New York City, and began his association with Edward R. Hewitt which continued, except for a brief period when he was with the Metzger Motor Car Co., until long after the Hewitt company was merged with International. Before he became affiliated with the automotive industry in 1910 he was with the following companies: General Electric Co., Lynn, Mass.; Corwin Mfg. Co. and Machine Sales Co., Peabody, Mass.

Col. Masury's interest in the Society was manifested by his participation in its work. He was second vice-president (representing motor car engineering) in 1923, and had been chairman and member of many Society committees. He was a vice-chairman of the Metropolitan Section in 1925. His last Society work was as a member of the following present committees: Diesel Engine Activity Committee; Automotive Transport Code Committee; Military Motor Transport Advisory Committee (in cooperation with the Quartermaster Corps., U. S. Army). Col. Masury had been a member of the last-named committee since 1931 and of the Diesel and Code committees for the last two years, during which time he also was a member of the Motorcoach and Motor Truck Activity Committee.

In 1924 Col. Masury became a member of the Ordnance Advisory Committee of which he served as chairman from 1928 to the time of his death. During 1930 he was a member of the Transportation and Maintenance Activity Committee. The national Membership Committee called him to become its chairman in 1925, and in the same year he was vice-chairman of the Motorcoach Division of the Standards Committee.

Col. Masury was a passenger on the Graf Zeppelin on the attempted transatlantic flight of that dirigible from Friedrichshafen, Germany, to America in May, 1929. His experiences aboard the Graf on that occasion were related by Col. Masury at the Airship Session of the semi-annual meeting of the Society in June, 1929, in a paper called "Notes on the Graf Zeppelin and Her Transatlantic Attempt."

In that paper he commented that, "as a money-making means of transportation the Zeppelin type of aircraft has a long way to go. It has possibilities for unusually long trips and for attaining publicity and, from a military viewpoint, it certainly is capable of awakening fear among the enemy." He also paid a tribute to German engineering ability when he said, "the progress made in the Zeppelin type of airship is largely due to German skill." It was Col. Masury's opinion that the fatalities in Zeppelin aircraft operation in the past may have been caused by unskillful maneuvering.

(Continued on following page)

Other papers were presented at Society meetings by Col. Masury on the following subjects: The Trend of Large Commercial Motor-Vehicle Design (1925); Future Problems of Motorbus Engineering (1924); Notes on Chassis Lubrication and Maintenance (1924); A Study of Road Impact and Spring and Tire Deflation (1920).

Born 50 years ago at Danvers, Mass., Col. Masury was graduated at Brown University as a mechanical engineer. He held his military title in the U. S. Army Reserve Corps. His automotive ability was called upon during the war when he served in an advisory capacity in the Army Ordnance Department. This association he continued through his work on the Society's Ordnance Advisory Committee.

Those who were acquainted with Col. Masury only by sight knew him as a vital figure, robust, hearty, red-haired. His friends—and no man had more for all who knew him well were his friends—knew how thoroughly the promise of his appearance was borne out by his vibrant personality. They knew him as a searcher after truth, with a fine appreciation of men as well as material things.

Outstanding among the many tributes to Mr. Masury's life and work which have come from his fellow Society members is the fine appreciation written by vice-president J. F. Winchester who was his close personal and business friend since early in life. In closing his encomium, Mr. Winchester writes of Col. Masury:

"He lived a full life—his sales ability and practical contact with every-day life enabled him to impress his associations with the current developments of his brain; many of these developments have been applied and are accepted as commonplace in the construction of automotive equipment which is working on the highways and byways of America and the world."

Erwin F. Ruehl

Erwin F. Ruehl, who joined the Society in 1930, died Feb. 28, 1933. Mr. Ruehl was chief engineer, Baldwin-Southwark Corp., Eddystone, Pa. Formerly he was assistant chief engineer of oil engines, I. P. Morris & De La Vergne, Inc., Philadelphia.

Mr. Ruehl was born at Stuttgart, Germany, Sept. 1, 1894, and graduated as a mechanical engineer at Stuttgart University in 1920. After being employed as designer and production engineer, Maschinenfabrik Thyssen & Co., Meelheim-Ruhr, Germany, he came to the United States in 1924 as designer for the Hooven Owens Rentscheler Co., Hamilton, Ohio. He held this position for four years before becoming associated with Morris-De La Vergne.

Personal Opinions

(Being terse phrases spoken or written by Members or by their guests and ferreted from their context by an editor in an inquiring mood)

The inherent strength of the automotive industry remains unshaken.—*Alfred P. Sloan, Jr.*

✧

Too many attempts have been made to design a car about a sales slogan or a list of features.—*James M. Crawford*

✧

We are reducing the price of automobiles until they are within the range of the purse of the worker of five years ago, and reducing salaries to the point where no one can afford automobiles except the higher paid executives.—*Raymond Whitaker.*

✧

Aviation is an expensive thing, but it is necessary, and without aviation today a nation cannot insure its protection or independence.—*Brig.-Gen. William Mitchell*

✧

Analysis of airplane failures in the air bring to light the fact that between 4 to 9 per cent of all accidents can be attributed to structural failures.—*T. P. Wright*

✧

Both a cheap plane which is inefficient and an efficient plane which is more expensive than it need be are uneconomical. —*Capt. Frank Courtney*

William E. Metzger

William E. Metzger, pioneer in the automobile industry, died April 11 at his home in Detroit at the age of 64. He had been in poor health for the last several years.

Since 1911 when he became a member of the Society, Mr. Metzer had been influential in S.A.E. work, although not through formal membership on committees. As chairman of the Insurance Committee of the National Automobile Chamber of Commerce he cooperated with the S.A.E. Advisory Committee on Automobile Locks. The committee was organized in 1926 when insurance interests were preparing to place a heavy premium on automobile theft insurance.

Mr. Metzger took a leading interest in the litigation which resulted in a decrease in the royalty payments on Selden's gasoline engines when the U.S. Supreme Court decided in 1909 that there had been no infringement on the Selden patent by his competitors.

Born Sept. 30, 1868, at Peru, Ill., Mr. Metzger's automotive career, spanning from the days of the bicycle and horseless carriage to present day automotive transportation, is well known to every one connected with the industry. He was a prime mover in organizing the Northern Motor Car Co., of Detroit; "E.M.F.", and Cadillac Motor Car Co. in which he was actively interested from 1902 to 1929. At the turn of the century he staged successfully the first auto show in New York City, and at the time of his death was vice-president of the Federal Motor Truck Co.

Meetings Calendar

Baltimore—May 18

Engineers Club of Baltimore; dinner 6:30 P. M.

Canadian—May 17

Royal York Hotel, Toronto; dinner 7:00 P. M.

Chicago

No meeting.

Cleveland—May 18

Portage Country Club, N. Portage Path, Akron, Ohio.

Luncheon 12:00 noon; golf and inspection trips to various Akron plants in the afternoon; dinner and entertainment 6:30 P. M.

Independent Wheel Suspension—a Résumé of European Practice—A. E. Ulman, Goodyear Tire & Rubber Co.

Dean Fred E. Aver, of the College of Engineering and Commerce, will also address the meeting, and the moving picture, "A New Development in Rubber" will be presented.

Metropolitan—May 18

Hotel New Yorker, New York City; dinner 6:15 P. M.

Joint Meeting of Aeronautic and Marine Divisions; speakers, Cy Caldwell, Z. D. Granville and T. F. W. Meyer.

Milwaukee—May 10

Koehring Plant, National Equipment Co., 6:30 P. M.

The Dumptor and Its Economy in Material Handling—Ralph T. Osman, sales mgr., Dumptor Div. National Equipment Co. Demonstration of the Dumptor in proving grounds and movies with a buffet supper after the meeting.

New England—May 10

Boston, Mass.

Outing with automotive engineering aspects.

Northern California—May 9

Elks Club, San Francisco; dinner 6:30 P. M.

Northwest—May 5

Bergonian Hotel, Seattle, Wash.; dinner 6:30 P. M.

Oregon—May 5

Multnomah Hotel, Portland; dinner 6:30 P. M.

Philadelphia—May 10

Engineers Club; dinner 6:30 P. M.

Extreme Pressure Lubricants—Dr. H. C. Dickinson.

Pittsburgh—May 11

Fort Pitt Hotel; dinner 6:30 P. M., with entertainment.

Southern California—May 19

Richfield Bldg. Cafeteria, Los Angeles; dinner 6:30 P. M.

Road Testing of Motor Fuels by Modern Methods—L. J. Grunder, automotive engineer, Richfield Oil Co., assisted by W. F. Hamilton and F. W. Thomas, also of Richfield Oil Co.

Washington—May 17

Sholl's, 1032 Connecticut Ave., Washington, D. C.; dinner 6:30 P. M.

News of the Sections

S.A.E. Section Activities at Peak as Dickinson and Warner Tour West

PRESIDENT H. C. DICKINSON and General Manager John A. C. Warner completed a trip on which they spoke before eleven sections when they attended the meeting of the Northwest Section on April 22 at Seattle, Wash. They started their return for the East on the following day. The trip was made in Dr. Dickinson's Ford sedan, and enabled the two officers to talk intimately with section members and governing boards about current section activities and plans as well as to speak formally at regular section meetings.

Interim reports received at Society headquarters from the two officers have indicated excellent records of S.A.E. performance by each of the sections visited. Long before President Dickinson and General Manager Warner reached the end of their 4222 mile transcontinental trip they were strongly impressed by the vital part Society members have been playing in making possible the statement by one of the automotive industry's leading executives that "The inherent strength of the automotive industry remains unshaken."

Dr. Dickinson on Economics

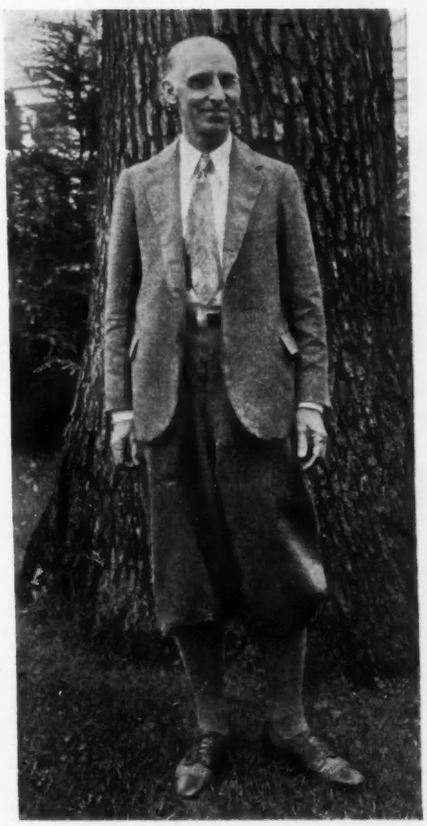
Complying with many previous requests, Dr. Dickinson presented his study of present economic problems entitled "Why Not Prosper?" at well-attended meetings of the Indiana, Chicago, Milwaukee, St. Louis and Northwest Sections. Dr. Dickinson's comprehensive discussion of the economic problems confronting the nation and the world was based on his address at the annual meeting on "The Mechanics of Recovery," which was printed in full in the February issue of the S.A.E. JOURNAL, and a subsequent presentation, "The Remedy," printed in the April issue. The sections hearing Dr. Dickinson's able discussion and the theories he advanced received the presentation in the same enthusiastic manner in which it has been acclaimed by engineers, bankers, economists and high executives in many industries throughout the country.

As chief of the Heat and Power Division of the National Bureau of Standards in Washington, Dr. Dickinson also told some of the sections the story, illustrated with motion pictures, of the Bureau's work in heat and power projects, testing, and automotive research and development, including the cooperative work by the Society and other associations on fuels and lubricants. The sections which heard this interesting account of the Bureau's activities were: Indiana, Chicago, Kansas City, Wichita, Denver Club, Southern California, Oregon and Northwest.

An exceptionally interesting film entitled, "Front Wheel Tramp and Shimmy Phenomena," prepared and dramatized at the laboratories of the famous Dr. Becker of Charlottenburg, Germany, was shown by Dr. Dickinson at most of the section meetings visited on the tour including St. Louis, Kansas City, Wichita, Denver Club, Southern California, Northern California, Oregon and Northwest.

At each of the eleven meetings, Mr. Warner spoke on "Forging Ahead with the S.A.E." He also served as official donor of prizes in the "Get-Your-Man" membership campaign recently staged by the national Membership Committee. In his talks about the Society Mr. Warner discussed some of the more important and recent accomplishments of members, particularly with relation to the newer products and in connection with the vigorous advancement in the automotive field in general. He also gave the members of the various sections visited new and interesting aspects of the Society's importance professionally in the general engineering and industrial picture.

President Visits Sections



President H. C. Dickinson talked about economics and Bureau of Standards automotive work before 11 sections on a speaking tour in which he and General Manager Warner covered more than 4000 miles from the Atlantic to the Pacific in a Ford sedan during the month of April.

Indiana

The Indiana Section's April meeting, the first meeting attended by Dr. Dickinson and Mr. Warner on their tour, was held April 3 at the Athenaeum, Indianapolis. A meeting of the Governing Committee and a dinner attended by 75 preceded the regular session at which Lee Oldfield, chairman, presided.

Prizes in the Get-Your-Man membership campaign were presented by General Manager Warner. Prof. H. M. Jacklin, associate professor of automotive engineering, Purdue University, and Section vice-chairman, won individual national

and section awards by obtaining six new members. The Section also won second place in the national standing. Prof. Jacklin received a year's paid-up dues for winning fourth place in the individual national contest and a radio for winning first place in the Section ranking.

Dr. Dickinson discussed current economic problems in his address entitled "Why Not Prosper?" He also described the activities of the Bureau of Standards, illustrating his talk with motion pictures. S.A.E. activities were reviewed by Mr. Warner.

Chicago

Preceding the regular meeting of the Chicago Section at the Sherman Hotel, April 4, the Governing Committee met and discussed matters in connection with the International Automotive Engineering Congress to be held Aug. 28 to Sept. 4 during the Century of Progress Exposition in Chicago.

The regular meeting, attended by 80, was addressed by Dr. Dickinson and Mr. Warner. President Dickinson presented his economic theory on "Recovery" and also showed motion pictures depicting activities of the Bureau of Standards. The work of the Society was outlined by General Manager Warner.

Leonard V. Newton, Byllesby Engineering & Management Corp., chairman of the Section presided and was presented with awards won in the recent membership drive. Mr. Warner, officiating as the donor, gave Mr. Newton an S.A.E. emblem as an individual national winner and a Gladstone bag as winner in the Section contest. He obtained 4 new members.

A free buffet supper was served at the close of the meeting.

Milwaukee

Ninety-six engineers, bankers and guests attended the meeting of the Milwaukee Section April 5 at the Milwaukee Athletic Club and heard Dr. Dickinson present his economic discussion and General Manager Warner tell about the S.A.E.

Prescott C. Ritchie, Waukesha Motor Co., Section chairman, presided. Mr. Warner presented individual section awards in the membership campaign to C. E. Frudden, chief tractor engineer, Allis Chalmers Mfg. Co., and treasurer of the Section and to Fred W. Stein, Fairbanks, Morse & Co., Beloit, both of whom obtained one new member. Each prize was a desk set.

Among the many who participated in the discussion following Dr. Dickinson's stirring address were: H. L. Horning, E. M. Keays, A. D. Chandler, F. P. Grutzner, F. M. Young, J. C. Slonneger and R. W. Wilson.

Before the regular meeting, there was a meeting of the Governing Committee followed by a dinner attended by 40 members and guests.

St. Louis

A big deal of three special features was given to members and their guests by the St. Louis Section at its April 6 meeting held at the Engineers Club. Chairman A. O. Payne presided.

Dr. Dickinson's address on "Why Not Prosper?," Dr. Becker's movie on "Front Wheel Tramp and Shimmy," and General Manager Warner's talk "Forging Ahead with S.A.E." were the headliners. In addition, prizes were awarded by Mr. Warner to winners in the membership campaign. George C. Stevens, branch manager, Diamond T Motor Car Co., and George M. Bicknell, chief engineer, Carter Carburetor Corp. each received desk sets.

Preceding the meeting, dinner was served at the Coronado Hotel with the Governing Committee attending.

Hoosier Gets Prizes

General Manager John Warner presenting prizes to H. M. Jacklin, vice-president Indiana Section, for having obtained the most new members for his Section in the recent Get-Your-Man campaign. In the white envelope, dangling below the radio, is another prize for Mr. Jacklin — one year's paid-up dues—which he won by placing fourth in the individual national standing. Indiana won second place in the Sections.

Kansas City

The April 7 meeting of the Kansas City Section, held at the Steuben Club following a dinner and meeting of the Governing Committee, brought out 50 members and guests who heard Dr. Dickinson describe the work of the Bureau of Standards. Moving pictures were shown in connection with Dr. Dickinson's talk. Dr. Becker's special film on the subject of shimmy also was presented by Dr. Dickinson. General Manager Warner spoke on S.A.E. activities. Chairman R. R. Matthews was in charge of the meeting.

Individual section awards in the membership drive were presented by Mr. Warner to R. F. Hardin, general shop foreman, City Ice Co., and Charles Stuck, traveling representative, E. S. Cowie Electric Co. An award also was announced as being made to Hugh C. Garrett, lubricants engineer, Magnolia Petroleum Co., Dallas, Texas, who resided in Kansas City territory when he "got his man." Gladstone bags were given as prizes.

Wichita

Dinner at the cafeteria of the Stearman plant, addresses by national officers, Dr. Dickinson, president and General Manager Warner, motion pictures and an inspection of the Stearman plant comprised a full program for the April 8 meeting of the Wichita Section.

Mr. Warner also presented desk sets to the following winners of individual section awards in the membership campaign: Andrew S. Swenson, owner, Swenson Motor Co. and vice-chairman of the Section, and C. A. Burnham, manager and chief engineer, Aircraft Sheet Metal Co.

Dr. Dickinson spoke on the activities of the Bureau of Standards and also presented Dr. Becker's film on shimmy. Mr. Warner's talk centered on the activities of the Society. About 40 members and guests attended the meeting which was conducted by Chairman Mac Short.

Denver

A meeting of the S.A.E. Club of Colorado was held at the Denver Club, April 11 when 150 heard Dr. Dickinson describe the work of the Bureau of Standards and General Manager Warner review activities of the Society.

George Gromer presided as chairman. A showing of the Becker film on shimmy concluded the program.

Southern California

More than 150 members and guests attended the April 17 meeting of the Southern California Section held in the Richfield Bldg., Los Angeles, and heard Dr. Dickinson describe the work of the Bureau of Standards and Mr. Warner talk about the S.A.E.

Dr. Dickinson also presented the special Becker film on shimmy.

Mr. Warner awarded a silver cocktail set to Charles H. Jacobsen, service manager, Moreland Motor Truck Co. and vice-chairman of the Section, for having obtained four members in the membership campaign. Mr. Jacobsen also received a national award in the form of an S.A.E. emblem for his good work. The Section won a banner for having obtained more members than the Northern California Section.

C. F. Lienesch, Section Chairman, presided.

A dinner was held before the meeting at which 60 members and guests were present.

Northern California

Meeting on April 19 at the Elks Club in San Francisco, members of the Northern California Section greeted Dr. Dickinson and General Manager Warner, and heard about S.A.E. activities and saw the special movie on shimmy, prepared by Dr. Becker of Germany. The movie was presented by Dr. Dickinson and Mr. Warner talked about the Society's doings.

Prizes in the membership contest were presented by Mr. Warner to Welwood E. Beall, aeronautic engineer, United Air Lines, Municipal Airport, Oakland, and to Russell H. Stalnaker, equipment engineer, State of California, Dept. of Public Works, Sacramento. Both received brown Gladstone bags.

A. B. Domonoske, chairman of the Section, presided at the meeting. About 50 were present.

Oregon

Dr. Dickinson and Mr. Warner visited the Oregon Section at its April 21 meeting at the Lloyd Golf Club, Portland. A motion picture depicting the work of the Bureau of Standards was presented by Dr. Dickinson, who also showed a film prepared by Dr. Becker on the subject of "Front Wheel Tramp and Shimmy Phenomena."

The activities of the S.A.E. were discussed by General Manager Warner. The meeting was in charge of H. W. Roberts, chairman of the Section.

Northwest

The Northwest Section met on April 22 at the Gowman Hotel, Seattle, Wash., when a large crowd turned out to hear Dr. Dickinson and General Manager Warner. It was the last Section meeting attended by the national officers on their country-wide tour.

"What the Bureau of Standards Is Doing for You" was the subject of a talk, illustrated by motion pictures, by Dr. Dickinson. Dr. Dickinson also showed another movie, a special film prepared by Dr. Becker, on the subject of shimmy.

Mr. Warner reviewed activities of the Society and officiated in the award of prizes to winners in the recent membership campaign. The individual national and section awards, an S.A.E. emblem and a Gladstone bag, were presented to Reese Lloyd, superintendent, Sunset Electric Co., for having procured four new members. Mr. Warner also awarded the Section Banner to the members for having obtained more new members than the Oregon Section.

Dr. Dickinson's address on "Why Not Prosper" was received with keen interest.

Cleveland Section Talks Education

College Leaders Take Part In Interesting Discussion

With a total registration of 185, the Cleveland Section held an interesting and instructive meeting at the Cleveland Club, April 10, which was featured by an address on education by C. B. Veal, manager of the research department of the S.A.E.

In addressing this "Father and Son" meeting, Mr. Veal likened the present economic situation to a jig-saw puzzle, in which the pieces representing supply and demand, savings and banking security, worker and job must be laboriously sorted out and painstakingly fitted together. He suggested to the younger generation that knowledge of the weak spots that have given way before the flood of circumstances and the bulwarks that have strongly resisted it, may prove a mental and spiritual inheritance neutralizing their unfortunate economic heritage.

In commenting upon the fact that the world of affairs is not governed by the orderly rule of science, but that it is a conglomerate of human beings, Mr. Veal said, that to deal with it effectively more than scholastic ability alone is necessary. He urged students to equip themselves with three types of weapons for the battle of life, those needed: (1) as an individual, (2) as a member of society, (3) as a professional man.

After calling upon his youthful listeners to fulfill their duty to themselves by establishing their physical and mental well-being, Mr. Veal pointed out the need of meeting their obligations to others through proper development of self-expression and thus contribute their share to an intelligent public opinion.

Mr. Veal discussed at length present opportunities and specific engineering requirements of the future. He pointed to research as one of the first needs indicated by the present economic and industrial picture and also emphasized the opportunities afforded in the field of operation and maintenance as well as in general industry.

After outlining the value of educational preparation Mr. Veal suggested specific fields of endeavor for the engineer. He advised students to study fundamentals and not attempt to specialize in any one narrow field of engineering.

Among the prominent discussers were: William Wickenden, president, Case School of Applied Science, Cleveland; Dr. A. B. Storms, president Baldwin Wallace College, Berea, Ohio, Dr. A. Caswell Ellis, director of Cleveland College; T. R. Nichols, dean of Fenn College, Cleveland; Prof. F. H. Vose and Dr. Hempke, both of the Case School.

A dinner before the meeting was attended by 60 members and guests. T. S. Kemble, chairman of the Section, presided at the meeting.

Pedestrians' Safety Receives Attention

New Englanders Discuss Present Safety Methods

Safety from the standpoint of the pedestrian, as well as the engineer and car manufacturer, was the subject discussed at the April meeting of the New England Section.

Pointing out that the manufacturers have cooperated in safety by building steel-core steering wheels, steel bodies, four-wheel brakes and other equipment calculated to meet increased speed, Lewis E. MacBrayne, general manager, Massachusetts Safety Council, called attention to improved highways and pedestrian education as other factors in the interest of safety.

"Pedestrians today must learn," Mr. MacBrayne said, "that measuring distance in the old way—when the pedestrian figured on the distance in feet, between himself and the approaching automobile—is unsafe. Today, distance must be measured in seconds, because the newer cars can go twice as far now in the same time it took a pedestrian to dodge than before."

Alfred W. Devine, assistant registrar, Motor Vehicles for Massachusetts told members that many drivers of motor-vehicles today do not realize that safety depends upon speed versus visibility, and that a stop must be made in any case within the assured clearance, that is, the distance that it is possible to stop a car going at nominal speed when an emergency arises.

Mr. Devine called the members' attention to the State law requiring inspection before May 1 of all registered motor-vehicles.

Robert C. Graham, vice-president Graham-Paige Motors Corp., Detroit, described how the manufacturers are incorporating safety features in automobiles. Mr. Graham, who is making a safety campaign throughout the East and South with "Cannon Ball" Baker, said that the movement for safety is gaining great impetus.

The meeting, held at Walker Building, M.I.T., Cambridge, was attended by 60 members and guests and 25 were present at a dinner which preceded the meeting. Dean A. Fales presided.

The Student Section has been active, having held regular weekly meetings during the last month. The students were addressed by M. C. Huckle on "Diesel Engines"; by Mr. Howell on "The Various Types of Self Shifting and Automatic Transmissions and Fluid Fly Wheels," and by H. M. Rugg on "Road Testing Vehicles for Fuel Performance."

Sales and Engineering Discussed at Buffalo

Faulkner Talks on Problems Facing Automotive Industry

That sales methods have not kept apace with the advancement along engineering and technical lines during the past few years, was the opinion expressed by Roy H. Faulkner, vice-president, Pierce-Arrow Motor Car Co., Buffalo, at a well-attended meeting of the Buffalo Section, April 18 at the Hotel Statler.

Mr. Faulkner decried the spending of the industry's energy in competitive battle and called for a concentrated effort to develop a broader market for all automobiles.

Speaking of today's automobile market, Mr. Faulkner emphasized the fact that it had by no means been shorn of opportunity for both the engineering and sales branches of the industry. "People have not lost their love for fine things," Mr. Faulkner said, "and just as long as human nature continues to be itself people will want newer and finer cars." He declared that a 25 per cent upturn in business would actually mean prosperity and that many companies could make money on a volume of business equivalent to one-third of their overhead in 1929.

Automobile engineers were urged by Norman G. Shidle, executive editor, S.A.E. JOURNAL, to keep in closer contact with dealer opinion. He emphasized the need for more frequent and informal field trips by technical men. In making a plea for more common enthusiasms between the engineer and sales departments Mr. Shidle said that much automobile advertising which is criticized as bunk is partly the result of lack of ability in the average engineer to assist merchandising divisions in the dramatization of technical matters, rather than any desire of copywriters to stick to glittering generalities.

The automotive engineer today, Mr. Shidle believes, is faced with a challenge to create new designs capable of making a major contribution and changing economic conditions—designs radical enough to bring about economic effects equal in importance, perhaps, to those which resulted from the original development of the automobile.

M. A. Thorne was in charge of the meeting which was preceded by a dinner given by the officers of the Section in honor of the speakers and a few guests.

Mr. Shidle talked the following evening to the Canadian Section at Toronto along similar lines. About 75 members and guests were present at the Buffalo meeting and 55 attended the meeting of the Canadian Section.

Met Section Considers Motor-Truck Taxation

The economics of motor transport taxation was vigorously discussed at the meeting of the Metropolitan Section held April 20 at the Hotel New Yorker, New York City.

Speaking from close personal contact and deep study of the subject, Arthur J. Scaife, past-president of the Society and consulting field engineer of the White Co., Cleveland, gave his views on highway transport taxation from the standpoint of its effect upon the design and application of commercial vehicles.

David Colton Fenner, manager Public Works Dept., Mack Trucks, Inc., New York City, and secretary Motor Vehicle Conference Committee, discussed motor truck taxation and what is wrong with present legislation. He contended that most of the laws of the various states on motor truck taxation are open to the serious

objection that they are not predicated upon any sound scientific basis.

R. J. Littlefield, supervisor, chief of passenger transportation, Pennsylvania Railroad, Philadelphia was among the prominent discussors at the meeting which was attended by 75 members and guests. A dinner, attended by 38, was held at the New Yorker preceding the regular session. The Motor Truck Association of America, Inc. participated in the meeting.

Philadelphia Stages Transportation Meeting

The April 19 meeting of the Philadelphia Section held at the Engineers Club, was featured by a comprehensive address on transportation standards by John F. Winchester, vice-chairman of the Society, representing transportation and maintenance engineering, and superintendent of motor vehicles, Standard Oil Co. of New Jersey.

A movie entitled "The Moving Pictures and Transportation"—a review of two great industries, was presented by J. B. White as a special entertainment feature. Thomas C. Fraser was chairman of the meeting which was preceded by a dinner at the club.

Causes of Accidents Interests Washington

Section Studies Engines—Both Human and Otherwise

A sky swarming with pilots who have inherent flying ability is impossible, according to Dr. R. F. Longacre, Director of the Medical Department of the U. S. Dept. of Commerce, one of the principal speakers at the April 12 meeting of the Washington Section at the Racquet Club. In other words there is no such thing as inherent flying ability.

Dr. F. A. Moss, professor of Psychology, George Washington University, and Maj. Gen. James E. Fechet, Retired Chief of the U. S. Army Air Corps, were the other speakers at the meeting which was preceded by a T-bone steak dinner with about 50 members and guests present, including four ladies and—two cases of beer (no reflection on the ladies).

Accidents due to physical defects are now almost unknown, Dr. Longacre pointed out, while those due to personal error are 60 to 90 per cent of the total. Though equally fit physically some people make much better pilots than others. Apprehensiveness and failure to relax and keep in mind the instructions are the chief difficulties of students who fail to qualify as first class pilots.

After saying that, "anything which exists can be measured," Dr. Moss gave it as his opinion that by careful measurements and tests dangerous drivers can be eliminated. "Various psychological tests are being developed," he said, "and it is likely that some of these will be adopted and used in the granting of driver permits."

Maj. Gen. James E. Fechet reviewed our present air equipment and looked to the future. We need, in his opinion, liquid cooled engines of the in-line type. They should be smaller, lighter, more powerful—around 1000 hp. Crankshaft speeds should be increased and gearing used. A geared supercharger on the ground should be complemented by an exhaust driven type at altitudes.

Fuel Experts Speak At Baltimore Meeting

Two outstanding authorities on fuel research engineering, Capt. Will Walter White, director of aeronautical research and flying equipment, Standard Oil Co. of New Jersey, and Neil MacCoull, director of mechanical research, The Texas Co., addressed the regular meeting on fuels held by the Baltimore Section at the Engineers Club, April 20.

Preceding the meeting, which was conducted by John A. White, Section chairman, a large number of members enjoyed a special dinner arranged for them by the club.

Tackle Problems on Motor Lubricants

Met Section Joins A.S.T.M. In Cooperative Discussions

THE joint meetings of the S.A.E. Metropolitan Section and the American Society for Testing Materials held March 8 in New York City, brought together the engineers of the two groups who are studying the same problems in motor lubricants from slightly different angles. Cooperative effort and general advancement toward agreement on many controversial factors involved marked this meeting as one of the most important of the year.

The joint gathering was a combination of the monthly meeting of the Metropolitan Section of the S.A.E. and the regional meeting of the A.S.T.M., the latter being under the general direction of the New York District Committee, the chairman of which is F. M. Farmer, vice-president and chief engineer, Electrical Testing Laboratories, New York.

About 350 were present at the afternoon and 400 at the evening meeting.

C. M. Chapman, President of the A.S.T.M., opened the afternoon meeting, while H. C. Dickinson, President of the S.A.E., and F. H. Dutcher, Chairman of the Metropolitan Section, were the first speakers in the evening. Dr. Dickinson unfolded further the economic plan which he first presented to the S.A.E. at the Annual Meeting in Detroit.

All arrangements for the meetings were made by J. G. Detwiler of the Texas Co., and H. C. Baxley of the Vacuum Oil Co.

T. C. Smith of the American Telephone and Telegraph Co. acted as chairman of both the afternoon and evening sessions. He was assisted by H. C. Mougey of General Motors Research Laboratories.

A brief synopsis of the papers follows. Complete papers are being prepared by A.S.T.M.

Carbon Deposit in Gasoline Engines—Dr. W. A. Gruse, Senior Fellow, Mellon Institute of Industrial Research. This paper outlined the causes of carbon deposits in gasoline engines. Various factors influencing the rate and amount of deposit were mentioned and experimental results were cited to show the magnitude of the effects described. An interesting part had to do with the influence of lubricating oil on deposits as compared with the fuel. Engine running conditions and oil consumption, frequency of cleaning the engine, amount of dust in the air, fuel ratios, engine design and conditions, characteristics of the fuel, and the characteristics of the oil were all discussed in their relation to the formation of carbon deposits.

The studies outlined in the paper indicated "that if an engine without an air cleaner runs cool on a rich air fuel mixture with a high oil consumption, the oil being one of high boiling point and high carbon residue value, the engine will very probably encounter a great deal of trouble, traceable to carbon deposits. The opposite conditions dust-free air, a hot-running engine with a lean air fuel mixture and low consumption of a volatile oil of low carbon residue value will very probably induce freedom from excessive deposits.

"Obviously, the cars on the road present all the permutations of all the shades of intervals of all these conditions. As regards the lubricating oil itself, this study suggests the desirability of hastening the day when the average motor can use, with tolerably low consumption, oils of much lower viscosity than the present S.A.E. No. 40 and 50 grades, and preferably oils of volatile type. These less viscous oils are more plentiful, are cheaper and are easier to refine to very high quality."

Present Concepts of the Relation of A.S.T.M. Pour Test to Service Requirements of Oils—J. L. McCloud, Metallurgical Chemist, Ford Motor Co. A sketchy outline follows:

The pour test was devised to determine the ability of oils to lubricate even at low temperature. It is necessary, of course, to determine the relation between the pour point and the service requirements of the oils in engines. Obviously, it is necessary for the oil to be applied to the bearings in operation and anything that prevents the starting of the motor as well as its continued operation is a factor of importance.

There was some mention of the desirability of modifying the A.S.T.M. pour test procedure in order to specify a slower rate of cooling to reflect more accurately the actual benefits obtained by Paraflow in lowering the pour points of oils.

The author calls attention to the fact that a low temperature coefficient of viscosity is necessary in automotive lubricants operating at low temperatures as well as a suitably low pour test. He indicated that tests made in the Ford Motor Company have led to conclusions closely confirming those outlined in the paper and have resulted in the feeling on the part of this company that cold tests in motors are necessary to indicate suitability of oils under definite conditions. It was carefully brought out that the A.S.T.M. pour point test shows suitability of the oil and does not provide a measure of quality necessarily, except as related to other tests.

Viscosity of Automobile Crankcase Oils as Related to Service Requirements—E. W. Upham, Chief Metallurgist, Chrysler Corp. This particularly interesting paper dealt with one of the most important considerations in the selection of lubricants—the interpretation of service requirements in terms of viscosity. The three basic requirements of crankcase lubricants, as indicated in the paper, are that viscosity limitations must be such as to:

1. Insure starting of the engine in cold weather.
2. Prevent excessive oil consumption.
3. Insure fluid film lubrication.

Tests were cited to show that under temperature conditions of 0 deg. Fahr., any oil with a maximum of 50,000 sec. viscosity is desirable for starting the average engine. The statement was also made that it is viscosity of the oil on the cylinder walls rather than at the bearings which lowers the starting revolutions per minute.

Factors affecting the choice of crankcase lubricant, such as gasoline consumption, and cushioning of bearings and pistons were discussed. The author believes that in the service field there is a tendency to use lubricants during the summer months that are heavier than those recommended by automotive engineers.

There was an excellent discussion of the pour test and viscosity papers by J. C. Genissee of the Atlantic Refining Co.; A. E. Becker of the Standard Oil Development Co.; C. M. Larson of the Sinclair Refining Co.; H. C. Dickinson, Bureau of Standards, and many others. In ad-

dition to the interesting group of slides shown with the papers, Mr. Larson contributed other excellent slides to illustrate his points.

Throughout the papers and discussion, one could not help but notice the undercurrent of napthenic base versus paraffin base which has been with us for a long time, the good points from both of which the representatives of the Standard Oil Company of New Jersey assure us they have amalgamated.

Service Changes in Crankcase Lubricating Oils—M. A. Deitrich, Graduate Student, Ohio State University. In the author's experiments and experience, used crankcase oils generally have showed a marked decrease in viscosity, flash, and pour points because of the dilution.

Decided increase is noted in carbon residue and ease of emulsification with water. The author states that sludge formed in the oils consists mainly of carbonaceous material formed by cracking or partial combustion of either the lubricating oil or the fuel. He states that in Diesel engines the sulphur content of the oil is fairly high and varies with the sulphur content of the fuel oil.

It is his experience that the changes in characteristics of crankcase oils during service are dependent far more upon the type of engine, its condition and its manner of operation than upon the characteristics of the new oils. The volatility, as measured by the spread in the distillation range and the viscosity in so far as it is affected by dilution at the time of service are the only characteristics which appear to have quantitative relationship to the changes which the oils undergo.

J. F. Winchester of the Standard Oil Co. of New Jersey presented the following comments upon the subject from a new angle: "We hear frequent discussion regarding the time period for changing crankcase oil. Some advocate short periods, others no change at all, and in the majority of cases, the economic results are based upon the saving in oil.

"Two other factors are, to my mind, important considerations; first—relative wear; second—relative gasoline consumption. Regarding the first, there remains a great deal to be investigated. I have never seen any data indicating the amount of dirt of the average type that an oil can carry without causing undue wear.

"Again, the character of oil used has a bearing on this subject and on engine design as well. Types of oils or engines that sludge rapidly, certainly need changes more frequently than those which do not.

"In the last few years, I have watched the second phase of this subject carefully and in some surveys made on relative oil consumption to gasoline, it has been drawn forcibly to my attention that gasoline consumption has been high where the period between changes has been prolonged indefinitely. As the ratio of oil used varies from 2.5 to 3.5, to 100 gal. of fuel, it can be realized that fuel economy through such practice creates a mounting loss on this item alone."

Mr. Libby raised a specter at the meeting in the guise of reclaimed oils. The speakers, it seemed, did not wish to go into that subject so that Herbert Chase of the *Automotive Daily News* has undertaken to secure the information which Mr. Libby desires and to make it available through the columns of his paper.

Oil Consumption in Motor Car Engines—H. W. Graves, Chief Metallurgist, Packard Motor Car Co. This rather exhaustive paper was prepared to correlate recent findings on oil consumption in motor car engines. Reference is made to the effect of engine speed, engine design and oil properties on oil consumption. Conclusions are based on motor dynamometers, chassis dynamometers and load tests. The important conclusions are:

1. "That engine speed is one of the two most important variables affecting oil consumption, and that doubling the speed may increase oil consumption from 2 to 20 times, depending upon engine design.

2. "That engine design is the second of the two most important variables affecting oil consumption and that small changes in design affect oil consumption greatly. Piston and piston rings are details of design having the greatest effect.

3. "That viscosity and volatility are the two important properties of oil that affect oil consumption. Oil consumption decreases with increased viscosity to a certain limit and then increases. Oil consumption increases with volatile oils only to a slight extent and is relatively unimportant by comparison with other factors."

Factors in Engine Design which Affect Oil Performance—A. Ludlow Clayden, Research Engineer, Sun Oil Co. Only a few of the points mentioned in Mr. Clayden's excellent paper can be given here. He believes that the oil consumed by average automobile engines is not in itself a matter of prime importance. If, however, the oil is considered as an essential part of an engine in the same sense as a mechanical part, then it may be regarded as a part of extremely poor durability.

The durability of engines as complete units would be improved by reducing the fatigue stresses in oil. A variety of possible modifications in mechanical design would accomplish this end. Methods of reducing oil wastage would also lessen fatigue stresses.

While changes in design of an extensive sort would be necessary to obtain maximum durability, there are many minor changes which could safely be made, which would improve the durability of oil in gasoline engines, and also the durability of the engine itself. It seems that in oil deterioration, the most serious deterioration in crankcase oils is contamination by abrasives.

Aircraft Engine Lubrication—Arthur Nutt, Vice-President in Charge of Engineering, Wright Aeronautical Corp. The author states that the aircraft engine industry would welcome oils which would permit the operations of engines at higher cylinder temperatures, as this limitation is becoming more imminent every year. Improvement in cylinder piston cooling has permitted some 20 per cent increase in mean effective pressures in recent years but the progress in this direction for service use is becoming less as some of the limitations resulting in heat are being approached. Superior oils must justify new increase in price and the proof testing will, of course, take a long time.

List of Discussers

The following members and guests offered discussion of the various papers:

George Arnt; Eugene Ayres, Gulf Refining Co.; L. C. Brand, Jr., Socony Vacuum Corp.; A. E. Becker, Standard Oil Development Co.; Clinton Brettell, R. H. Macy Co.; James W. Cottrell, Chilton Co.; H. C. Dickinson, Bureau of Standards; C. S. Fliedner, Bureau of Aeronautics, Washington; J. C. Geniesse, Atlantic Refining Co.; R. T. Haslam, Standard Oil Development Co.; Robert Job, Consulting Chemist, Montreal; C. M. Larson, Sinclair Refining Co.; A. D. T. Libby, Electrical Engineer and Patent Attorney; H. C. Mougey, General Motors Research Laboratory; George L. Neely, Standard Oil Co. of California; J. B. Rather, Socony Vacuum Corp.; T. H. Rogers, Standard Oil of New York; G. A. Round, Socony Vacuum Corp.; J. P. Stewart, Socony Vacuum Corp.; S. G. Tilden, S. G. Tilden, Inc.; R. E. Wilkin, Standard Oil Co. of Indiana; J. F. Winchester, Standard Oil Co. of New Jersey, and George W. Zabel, Fairbanks-Morse Co.

Pittsburghers Show Keen S.A.E. Interest

Discuss Economic Theory and Lubricants Problems

A double-feature program brought out a large attendance at the March meeting of the Pittsburgh Section when Dr. H. C. Dickinson, president of the Society, gave his address on The Mechanics of Recovery and H. C. Mougey discussed Extreme Pressure Lubricants from the Standpoint of the Car Owner.

Excerpts from Mr. Mougey's paper are printed on page 196, TRANSACTIONS section, in this issue. The author, who is chief chemist and assistant technical director, General Motors Research Laboratories, Detroit, has done considerable work in developing machines and methods which would be commercially practical in evaluating the characteristics of extreme pressure lubricants in terms of actual performance on the road. His paper aroused considerable discussion of extreme pressure lubricants problems.

Dr. Dickinson, in commenting on the curious fact that some of the oldest sciences are the least developed, pointed out that only during recent years has there been much popular (or unpopular) interest in one of the oldest sciences—economics. Dr. Dickinson's economic theory, presented first to the Society at its annual meeting in January, 1933, was published in the February issue of the S.A.E. JOURNAL.

A number of out-of-town visitors were among the 200 who attended the meeting held at the Fort Pitt Hotel, March 21. An unusually large delegation of members drove over the snow-covered roads from Oil City. A. J. Scaife, past president of the S.A.E., and A. K. Brumbaugh, White Co., members of the Cleveland Section, spoke briefly.

John A. C. Warner, secretary and general manager of the Society, commented on the keen interest shown in S.A.E. activities by the Section. Mr. Warner was guest speaker at the first meeting of the Pittsburgh Section four years ago. Others at the speaker's table were Dr. H. T. Kennedy, Gulf Refining Co., and Dr. Wm. A. Gruse, in charge of petroleum research, Mellon Institute. Dr. Gruse led the discussion and C. R. Noll, Gulf Refining Co., was chairman.

In the discussion on Mr. Mougey's paper, Dr. Gruse commented on the casual manner in which the author had told how he could multiply the load carrying capacity of lubricants by adding a little of "this or that." He said that it could only be compared with the advances made in the antiknock properties of gasoline as fuel by adding substances such as tetra-ethylene lead.

Oscar Wikander, Edgewater Steel, in discussing the effect of speed upon the seizing point, told of an instance where performance had been good at loads of 60,000 lb. per sq. in., but that there had been a tendency to seize and gall at only 40,000 lb. when the speed was exceptionally low.

Extreme pressure lubricants seem most valuable in preventing the scoring of gears in the opinion of Mr. Baggaley, McCrady-Rogers Co.

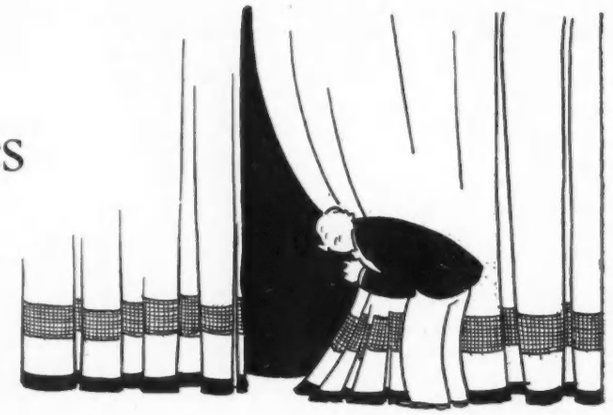
Joseph A. Harvey, Pittsburgh Motor Coach, raised the question that the curves of viscosity and the results obtained from testing machines did not seem to correlate with those of actual service. Mr. Mougey replied that service records were the only adequate answer, as yet, to the question as to which extreme pressure lubricants are apt to have the most desirable and the least number of undesirable features.

John M. Orr, Equitable Auto Co., Dr. Kennedy, Mr. Walters, Motor Service, and Mr. Schill were among the prominent discussers.

Previous to the meeting a hundred members and guests attended a dinner at the Fort Pitt.

Behind the Scenes

With the Committees



Aviationfuel

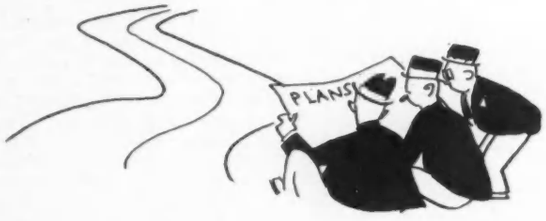
AVIATION Gasoline Detonation Research Committee is pursuing actively its efforts to evolve a method of rating aviation fuels. It is seeking to bring into existence for aviation fuels a rating basis of the same sort as has been developed for automobile fuels after several years of intensive work. At the request of this committee the Cooperative Fuel Research Committee at its last meeting accepted sponsorship of this undertaking.

The experience gained in the motor fuel work, of course, is being applied in this present activity. P. B. Taylor, Wright's chief engineer who is active in this work, estimates that six months' time will be required for the proposed engine tests and that at least a year must elapse before a definite method of rating can be evolved and made ready for general use.

In the meantime, a special engine subcommittee, a special fuel subcommittee and a ways and means committee have been appointed and work is going forward steadily.

Advisory

THE Highways Research Subcommittee is arranging for personal contact with the Bureau of Public Roads and with the American Association of State Highway Officials. It hopes to "render advisory service in the planning and direction of scientific investigations of factors and phenomena directly affecting the utilization rather than the construction of the Country's highways."

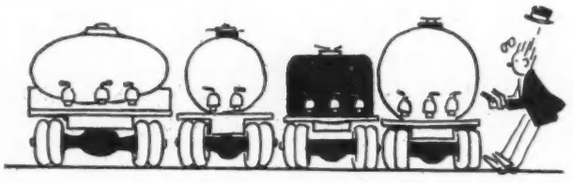


Tanks

LARGELY through the initiative of Vice-President J. F. Winchester of the transportation and maintenance activity, the Society has started work on a standardization project designed to reduce materially the variety of tanks on gasoline tank trucks now being used—a result which would be extremely beneficial both to the truck manufacturers and operators by permitting a better gross load and load distribution on front and rear axles.

Mr. Winchester is chairman of an A. P. I. committee on Standardization of Equipment which has been studying this subject for some time back. Last November he made a progress report for that committee which contained a wealth of detailed data and some definite recommendations.

In January, the motorcoach and motor truck division of the S.A.E. standards committee authorized organization of a subdivision to cooperate with this A. P. I. committee. This subdivision "on gasoline tank and tank truck standardization" as finally constituted includes, under the chairmanship of Past-President A. J. Scaife, the following: B. B. Bachman, G. S. Piroomoff, John T. Ryan, A. W. Scarratt, Pierre Schon, E. W. Winans, B. F. Wright, G. W. Thomas.



This committee is now engaged in studying Mr. Winchester's comprehensive progress report as a basis for further discussion and action. The report covers standardization of gasoline tanks and tank trucks with reference to (1) the C. A. dimensions; (2) tank sizes and capacities. The A. P. I. Committee has considered 600, 900, 1000, 1200, 1500 and 2000 gal. capacities as a proposed standard from a dimensional standpoint, with the exception of the 1200 gal. tank wherein only one size was considered.

Military

IN October, 1931, a General Advisory Committee was appointed by the S.A.E. to attend a conference called by Maj.-Gen. J. L. DeWitt, Quartermaster General's Dept., Washington, D. C. This committee was to render the technical advice of the automotive industry on the department's problems in design and construction of military motor transport equipment.

The committee has since then reviewed the program as developed by the Quartermaster General's department and has advised the department as to its feasibility, applicability, etc., not having concerned itself with designs or details.

Commercial interests involved will continue to cooperate in an advisory capacity, as they may be asked to do so. The Government, however, must lay down definite plans for the future, and wants the guidance of the industry through the S.A.E.

Fitting Transit Equipment to Its Best Job

(Continued from page 20)

cerned, to a relatively small capacity as compared to electric cars.

8. It cannot reach the high running speed of the gas bus and so is confined to frequent stop service.

The Trolley Car

In attempting to evaluate the trolley car, it should be borne in mind that of the 50,000 odd trolley cars in use in the United States about half are 20 years old or more; that a great deal of progress has been made in the design of cars, as in other lines; and that in attempting to evaluate these different vehicles the modern trolley car should be taken as the basis of comparison. These 20-year old cars should not be compared with a modern motor bus or trackless trolley any more than the modern motor bus should be compared with its solid tired predecessor of 10 years ago.

The advantages of the electric surface car as compared to the other two types of equipment under discussion, are:

1. Lower direct operating cost per seat mile. (Whether the over-all cost will be lower depends upon the density of traffic and the capital charges which it is necessary to absorb.)

2. It will carry the greatest number of seated passengers per square foot of street space.

3. It can be built in single units of any reasonably desirable size.

4. It will operate more miles with less attention than either of the other types.

5. It will operate more miles per failure than either of the other types.

6. It has a longer life than either of the other types and, therefore, can be depreciated at a lower rate.

7. It can be maintained, particularly as to routine maintenance, without a highly skilled organization.

8. By reason of the long history back of car development, there is little, if anything, of an experimental nature in the design of cars and their component parts, making less hazard as to operating troubles and maintenance expense.

9. By reason of the large capital cost required for the tracks and line, it offers the greatest possible assurance of permanence of route.

10. Requires less skill for operation than either of the other vehicles.

11. Can be well heated, lighted and ventilated.

12. By the use of modern devices, such as the so-called "deadman" control, safety exit doors and similar features, and because of the substantial nature of the construction, it offers the maximum of safety to riders.

13. By reason of the high power to weight ratio, it can accelerate and decelerate at rates limited by passenger comfort.

14. Being guided by tracks, there is no danger of skidding accidents.

The trolley car also has certain disadvantages which must be charged against it:

1. The high capital cost for line and track makes its operation uneconomical in the lighter traffic densities.

2. It is fixed as to route and cannot detour around traffic obstructions.

3. It discharges passengers at the line of track. This represents a certain obstruction to other street traffic while the vehicle is stopped, and also usually results in discharging the passengers at a point remote from the curb. (In well organized transportation systems, where street width permits, these objections are overcome by the use of suitable safety islands.)

4. While normal stopping is limited by passenger comfort, emergency stops are limited by the adhesion of the wheels to rail, which is inferior to rubber tires on the pavement.

5. It is noisier in operation.

6. Vibrations from the rail and wheel contact are transmitted to the car and passengers.

7. It is inferior from the standpoint of street accidents.

It is probably true that considering the average electric surface car in common use, additional objections can be found. On the other hand, developments under way at the present time indicate that many of the objections which have been listed as valid against even present day modern cars will be shortly eliminated, or at least materially reduced.

In closing, a word may well be said about the merits of public transportation generally as opposed to the use of the private automobile. A seated passenger on a surface car occupies a street space of 4½ sq. ft. The same seated passenger in a single deck motor bus occupies 6.7 sq. ft. The average passenger automobile carries a load of 1.7 passengers, which means that each passenger occupies a space of 53 sq. ft. To say it in another way, one ordinary 60-ft. street with a double track car line, with cars carrying only seated load, will provide service for more people than 3½ streets of the same width devoted exclusively to the automobile. The ordinary street car will carry as many seated passengers as are ordinarily carried in 36 private automobiles, requiring some 15 times the street space. Think what this would mean in the way of street congestion, to say nothing of the economic cost to the community.

Cost Per Passenger Mile

The average rate of fare during 1931 for surface lines in the cities of the United States of more than 100,000 population, was 6.7 cents. The average length of ride was about 3 miles. It will, therefore, be seen that the cost per passenger per mile, based on the average length of ride and the average rate of fare, was 2¼ cents. A man driving his own automobile will have a cost varying from some 5½ cents per mile up—the average probably being 9 cents. If the value of downtown street space be set as the same as the abutting property and if the driver of the private automobile be assessed in proportion to his use of such space, the true relative operating cost of the private automobile will be very much higher, as these figures indicate.

To assure an orderly selection of the proper types of equipment for the various services intended, the operation of public transit facilities in a given community should be a monopoly under suitable regulation. This should include taxicabs. When so constituted the management of such a monopoly can study the advantages and disadvantages of the various types of equipment offered and can select for the various services the most suitable equipment in each case. Most of the larger and more progressive city transit organizations have well-trained staffs for studying each situation.

Notes and Reviews

THESE items, which are prepared by the Research Department, give brief descriptions of technical books and articles on automotive subjects. As a rule no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.

AIRCRAFT

Static Thrust of Airplane Propellers

By Walter S. Diehl. N.A.C.A. Report No. 447, 1932; 8 pp., with tables and charts. Price, 5 cents. [A-1]

The Drag of Two Streamline Bodies as Affected by Protuberances and Appendages

By Ira H. Abbott. N.A.C.A. Report No. 451, 1932; 8 pp., with tables and charts. Price, 5 cents. [A-1]

Jet Propulsion with Special Reference to Thrust Augmentors

By G. B. Schubauer. N.A.C.A. Technical Note No. 442, January, 1933; 37 pp., 36 figs. [A-1]

Wind-Tunnel Research Comparing Lateral Control Devices, Particularly at High Angles of Attack. VII—Handley Page Tip and Full-Span Slots with Ailerons and Spoilers

By Fred E. Weick and Carl J. Wenzinger. N.A.C.A. Technical Note No. 443, January, 1933; 20 pp., 11 tables, 11 figs. [A-1]

Working Charts for the Stress Analysis of Elliptic Rings

By Walter F. Burke. N.A.C.A. Technical Note No. 444, January, 1933; 6 pp., 6 figs. [A-1]

Improved Apparatus for the Measurement of Fluctuations of Air Speed in Turbulent Flow

By W. C. Mock, Jr., and H. L. Dryden. N.A.C.A. Report No. 448, 1932; 26 pp., illustrated. Price, 10 cents. [A-1]

The Estimation of Maximum Load Capacity of Seaplanes and Flying Boats

By Walter S. Diehl. N.A.C.A. Report No. 453, 1932; 5 pp., with tables and charts. Price, 5 cents. [A-1]

Wind-Tunnel Research Comparing Lateral Control Devices, Particularly at High Angles of Attack. VIII. Straight and Skewed Ailerons on Wings with Rounded Tips

By Fred E. Weick and Joseph A. Shortal. N.A.C.A. Technical Note. No. 445, February, 1933; 13 pp., 3 figs., 18 tables. [A-1]

The Effect of Lift, Drag, and Spinning Characteristics of Sharp Leading Edges on Airplane Wings

By Fred E. Weick and Nathan F. Scudder. N.A.C.A. Technical Note No. 447, February, 1933; 15 pp., 11 figs. [A-1]

Wind-Tunnel Research Comparing Lateral Control Devices, Particularly at High Angles of Attack. IX. Tapered Wings with Ordinary Ailerons

By Fred E. Weick and Carl J. Wenzinger. N.A.C.A. Technical Note No. 449, February, 1933; 14 pp., 16 tables, 3 figs. [A-1]

Effect of Aileron Displacement on Wing Characteristics

By R. H. Heald. N.A.C.A. Technical Note No. 448, February, 1933; 10 pp., 4 tables, 9 figs. [A-1]

The Calculation of Take-Off Run

By Walter S. Diehl. N.A.C.A. Report No. 450, 1932; 10 pp., with tables and charts. Price, 5 cents. [A-1]

The Process of Separation in the Turbulent Friction Layer

By E. Gruschwitz. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 23, No. 11, June 14, 1932; Verlag von R. Oldenbourg, München und Berlin. N.A.C.A. Technical Memorandum No. 699, February, 1933; 10 pp., 3 figs. [A-1]

The Problem of the Propeller in Yaw with Special Reference to Airplane Stability

By Franz Misztal. Translated from *Abhandlungen aus dem Aerodynamischen Institut an der Technischen Hochschule Aachen*, No. 11, 1932. N.A.C.A. Technical Memorandum No. 696, January, 1933; 33 pp., 20 figs. [A-1]

The D. V. L. Gliding-Angle Control (W. Hübner Design)

By Walter Hübner and Wilhelm Pleines. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 23, No. 15, August 12, 1932; Verlag von R. Oldenbourg, München und Berlin. N.A.C.A. Technical Memorandum No. 697, January, 1933; 9 pp., 8 figs. [A-1]

Dynamic Breaking Tests of Airplane Parts

By Heinrich Hertel. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 22, Nos. 15 and 16, August 14 and 28, 1931; Verlag von R. Oldenbourg, München und Berlin. N.A.C.A. Technical Memorandum No. 698, January, 1933; 42 pp., 44 figs. [A-1]

Versuche zur Beseitigung von Leitwerkschütteln

By Curt Biechteler. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Jan. 1, 1933, p. 15. [A-1]

Tail plane vibration in low-wing type airplanes at large angles of attack having been observed, the German institute for aeronautical research undertook an investigation of this phenomenon. The causes were studied by means of flight tests, and as a preventive two types of fairing were tried. They were found to obviate the vibration and not to interfere with the flight characteristics of the airplane. Preference was given to one type of fairing because of its simplicity of design and ease of manufacture.

Ergebnisse von Messungen der Statischen Längsstabilität Einiger Flugzeuge

By Walter Hübner. Published in *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Jan. 28, 1933, p. 47. [A-1]

In flight tests with fixed rudder, with engine at wide open throttle and idling, the static stability of aircraft of seven different types was determined. The results are given in this technical note of the German institute for aeronautical research.

CHASSIS PARTS

Versuchsfahrten zur Ermittelung der in Kraftfahrzeugbremsen Auftretenden Temperaturen

By Dr. Wiegand and Winkler. Published in *Automobiltechnische Zeitschrift*, Jan. 25, 1933, p. 38. [C-1]

Brake temperatures were observed by the engineering college of Dresden for two motorcoaches, two passenger-cars and one motorcycle on runs made with disengaged clutch on an especially steep and long descent. The conclusion reached is that under these conditions brake drum temperatures in ordinary motorcoaches and passenger-cars will not rise more than 230 deg. cent. (414 deg. fahr.) above atmospheric, while in a motorcycle this rise may be 350 deg. cent. (630 deg. fahr.)

ENGINES

Estimation of the Variation of Thrust Horsepower with Air Speed

By Shatswell Ober. N.A.C.A. Technical Note No. 446, February, 1933; 6 pp. [E-1]

Type de Diagramme Commun aux Moteurs à Explosion et à Combustion Interne

By A. Grebel. Published in *Le Génie Civil*, Feb. 4, 1933, p. 111. [E-1]

Conventional representations of the theoretical Otto and Diesel cycles by means of pressure-volume diagrams are based on hypotheses contrary to reality. After supporting this accusation by pointing out a number of particulars in which actual performance differs from the diagrammatic representation, the author refers to ordinary type of pressure-time diagram. This he criticizes on the ground that the time scale is too small and recommends rescaling it and having photographic recording instruments changed accordingly. He describes the suggested new type of pressure-time diagram representing the actual phenomena of compression, combustion and explosion in high-speed engines and illustrates its application to Diesel, semi-Diesel and Otto cycle engines.

Zur Kenntnis der Strömungsvorgänge im Durchflussquerschnitt von Einlassventilen Raschlaufender Verbrennungskraftmaschinen

By K. Schlaefke. Published in *Automobiltechnische Zeitschrift*, Jan. 25, 1933, p. 28. [E-1]

A simplified method for calculating the flow characteristics through inlet valves of high-speed engines is here worked out. Two formulas are developed, one for Diesel and one for Otto cycle engines.

Schalldämpfer für Automobilmotoren

By Dr. Ing. Alfred Kauffmann and Dr. Ing. Ulrich Schmidt. Published by M. Krayn, Berlin. 103 pp.; 101 illustrations. [E-1]

The science of acoustics as well as that of gas flow should be taken into account in the appraisal and designing of mufflers. With this as their premise, the authors open their thesis with an analysis of the origins of exhaust noise, dwelling on the effect of engine speed and load and on the frequency range of the sound at its place of origin. Transfer of the sound through the exhaust pipe is then traced, and the contributing effects of the exhaust piping and other intermediate factors are explained. Finally, the distribution of sound and energy for different final cross-sectional areas of exhaust pipe is investigated.

Turning to design, the authors first outline the fundamental acoustic requirements. They describe a specially developed equipment and method for measuring the frequency of mufflers and their effectiveness in damping exhaust noises.

The second phase of design, that involving the study of gas flow, is next discussed. The relation between exhaust back-pressure and engine performance is illustrated by engine tests. On this basis a merit rating for mufflers from the viewpoint of gas-flow technique is developed.

A final section takes up the question of body noise and the contribution to it of exhaust noise.

High Speed Diesel Engines

By Arthur W. Judge. Published by D. Van Nostrand Co., Inc., New York City, 1933; 248 pp., illustrated. [E-3]

This volume is intended as an elementary textbook on the theoretical and practical aspects of the high speed compression-ignition engine, for the use of automobile and aircraft engineers, students and others interested in this new internal combustion engine development.

An outline of the present knowledge of the theory of the high-speed Diesel is given in so far as the elementary nature of the book permits. In this respect a good deal of original research work has been carried out by various authorities; references to these sources of information are given in the footnotes and in the bibliography at the end of the book.

MATERIAL

Alloys of Iron and Molybdenum

By J. L. Gregg. Published for The Engineering Foundation by the McGraw-Hill Book Co., Inc., New York and London, 1932; 507 pp., illustrated. [G-1]

This monograph was prepared at Battelle Memorial Institute as a part of the Institute's contribution to the Alloys of Iron Research Series. These monographs are a concise but comprehensive critical summary of research on ferrous alloys as reported in the technical literature of the world. They contain a discussion of all available data on binary and higher ferrous alloy systems, and on the effect of the alloying elements on carbon steel and on simple and complex alloy steels and special alloy cast irons.

The purpose of this monograph is to make available in readily useable form the important facts on molybdenum steels and the other alloys of molybdenum and iron, with or without additional alloying elements.

More than a thousand articles were located, and 800 were studied in detail and specially abstracted for the information included in this book.

A comprehensive bibliography and subject index form a valuable part of the work.

Mercerization of Cotton for Strength with Special Reference to Aircraft Cloth

By J. B. Wilkie. N.A.C.A. Technical Note No. 450, February, 1933; 16 pp., 5 figs. [G-1]

Laboratory Experiments on Gum-Bearing Gasolines

By S. P. Marley and W. A. Gruse. Published in *Industrial and Engineering Chemistry*, November, 1932, p. 1298. [G-1]

This paper presents data on preliminary experiments on a study of the significance of gum content of gasoline as related to gum deposits. The results were obtained under laboratory conditions and with experimental equipment, and the authors warn that they should not be interpreted as setting directly any gum tolerances for commercial motor fuels. They do, however, indicate some significant probabilities as to gum tolerance, and they also emphasize what the writers regard as a new importance for one of the principles of engine design.

The Knock Rating of Δ^{8}-Olefines—A Contribution to the Study of the Significance of Olefines in Cracked Petrol

By F. H. Garner, R. Wilkinson and A. W. Nash. Published in the *Journal of the Society of Chemical Industry*, Aug. 12, 1932, p. 265T. [G-1]

The authors outline briefly some of the significant steps in the progress of fuel knock rating and stress the prime importance of the investigation of the engine performance of pure hydrocarbon fuels. Reference is made to the work of Ricardo; Callendar, King, and Sims; Stevens and Marley; Edgar; Howes and Nash; Birch and Stansfield; and recently by Lovell, Campbell and Boyd.

The study reported in this paper is an extension of the work on the knock rating of pure hydrocarbons using an Ethyl Gasoline Series 30 (modified Delco) testing unit.

Die Bewertung von Schmierölen durch Untersuchung und Betriebsversuche

By Dipl-Ing. Ernst W. Steinitz. Published in *Automobiltechnische Zeitschrift*, Oct. 25, 1932, p. 499. [G-1]

How may the quality of an engine lubricating oil be judged? The author of this article gives only a negative answer in warning that the examination of oils according to the customary specification tests is useless; that appraisals can be made only if test results are rightly interpreted, which in itself calls for a special technique; and that even comparative service tests call for special methods and apparatus if the correct conclusion is to be drawn.

MISCELLANEOUS

Il Faut Déferrer les Chemins de Fer

By Marcel de Connick. Published in *La Vie Automobile*, Oct. 10, 1932, p. 514. [H-1]

Take the iron out of the "iron horse", is the advice of the author in urging that the rails be torn from the railroad tracks, the routes paved and the automotive vehicle substituted for the steam train. The proposal for the coordination of the two methods of transportation he scouts as an economic contradiction. They are by nature incompatible, he asserts, the train being adapted to the movement of large loads over long distances and the automobile to relatively light loads at short distances. Coordination of the two merely saddles the motor-vehicle with the disadvantages inherent in the railroad.

Dealing separately with passenger and goods transportation, the author presents figures intended to prove his contention that everything accomplished in France by the railroads can be duplicated by 140,000 motor-trucks and 25,000 12-passenger motorcoaches, or about 10 per cent of the actual motor-vehicle capacity of the country. To the argument that railroads alone can handle large-scale traffic, he presents considerations tending to show the greater capability of the automobile for this type of service. To the contention that motor-vehicles cause road wear, he answers that modern highway maintenance does not call

for nearly as much expenditure as railroad-track maintenance. Is it Utopian to imagine the abolition of railroads? he queries. No, it is Utopian to believe that the people of France can continue to bear for much longer the financial drain inflicted by the continuous operating losses of the railroads.

Les Projecteurs d'Automobile

By Pierre Cibié. Published in *Journal de la Société des Ingénieurs de l'Automobile,* January, 1933, p. 2002. [H-1]

Opening his discussion of automobile headlamps with a description of the ideal light distribution, the author specifies a beam pattern rectangular in shape, with maximum intensity at the axes, diminishing toward the sides and the top and bottom, but much more rapidly toward the bottom than the top to avoid a bright light in the foreground.

Reflectors, in his opinion, should approach as nearly as possible a true parabola in form, and the proper dimensions for reflectors are discussed as well as certain types of non-parabolic reflectors. Diffused lighting is not and corrugated lenses are recommended. Other topics covered are lamps, sockets, mounting, the variation of light intensities with voltage, non-glare requirements and the functioning of headlamps in the fog.

Technische Zahlen und Tabellen aus der Kraftfahrzeug-industrie

Published by Dr. Ernst Valentin, Verlag, Berlin, Germany; 32 pp., illustrated. [H-1]

The technical aspects of the automotive industry are summarized in the figures and tables of this booklet, compiled by the Reichsverband der Automobilindustrie. The pamphlet supplements that of this association on the transport and economic phases of the industry. Data are given on the relative usage of constructional features of various types, and a complete table of specifications for all German automotive vehicles is included. Price trends are traced and the price of each make of vehicle as of April, 1932, is given.

Les Progres de la Construction Automobile Révélés par le Dernier Salon de Paris

By G. Delanghe. Published in *Le Génie Civil,* Nov. 12, p. 477; Nov. 19, p. 498; and Nov. 26, 1932, p. 522. [H-1]

A few of the more important technical developments that featured the significant general progress characterizing the latest automobile show at Paris are discussed in this article. Aspects covered are the reasons for these particular developments, the history of their evolution and the specific designs in which they have been realized.

Among the topics so dealt with are the elastic suspension of engines, including floating power developed by Chrysler and applied by Citroën in France and the so-called "damped" suspension of Renault; increased frame rigidity; independent wheel suspension, which has gained six new adherents in France and two in other countries in the last year; increased rigidity and streamlining of bodies; and transmission improvements related to greater quietness of operation, ease of gear-shifting and free-wheeling.

Ce Que Peuvent Dire les Appareils de Contrôle

By Henri Petit. Published in *La Vie Automobile,* Nov. 10, 1932, p. 563. [H-1]

What is the story the instrument panel tells? To determine the nature, accuracy and range of the information given by the instruments, the author analyzes the design and operation of those customarily found on the instrument boards of modern automobiles—the oil-pressure gage, ammeter, speedometer, tachometer, fuel-level gage, radiator and oil thermometers, manifold-depression indicators and clocks.

Of those of former days he makes passing mention—the altimeter, gradometer, battery-charge indicator, oil-level indicator, portable thermometer and average-speed indicator.

The New Necessity

By Charles F. Kettering and Allen Orth. Published by The Williams and Wilkins Co., in cooperation with The Century of Progress Exposition, Baltimore, 1932; 124 pp. [H-3]

Approximately forty years have passed since the Chicago World's Fair at which was exhibited an automobile of European extraction; really America's introduction to the automobile, the authors point out. With the advent of another Fair in Chicago in 1933, the central theme of which is a Century of Progress, they have taken the opportunity to review the highlights in the story of what "America has done about the automobile in those forty years and, what is equally as important, what the automobile has done to America."

This book and twenty or more others comprise the Century of Progress Series published in collaboration with the Advisory Committee on Scientific Publications, of the Exposition.

Heat Transmission

By William H. McAdams. Published by the McGraw-Hill Book Co., Inc., New York and London, 1933; 383 pp., illustrated. [H-3]

This volume, sponsored by the Committee on Heat Transmission of the National Research Council, is a comprehensive treatise on the various fields of heat transmission, based on considerable unpublished data as well as on a critical examination of the literature. Reliable data from the most diverse sources, including many unpublished results, have been reduced to a common basis for purposes of comparison and have been correlated in the light of the most helpful theoretical analyses. The results of these critical studies are presented as formulas and graphs constructed to give due weight to all the data and at the same time to make the results readily available for use in engineering design.

The book is divided into three parts: conduction, radiation, and convection.

The Appendix contains tables and charts of thermal conductivities, specific heats, latent heats of vaporization, and viscosities, and miscellaneous tables, such as steam tables, conversion factors, and dimensions of steel pipe.

Le Déficit dans l'Exploitation des Grands Réseaux Français de Chemins de Fer

By Ch. Dantin. Published in *Le Génie Civil,* Jan. 7, 1933, p. 9. [H-4]

Familiar to automotive engineers will be the counts on which the French railroads attribute to motor-vehicles partial responsibility for their present critical financial condition. Motor-vehicles, they say, enjoy almost entire liberty in fixing rates, whereas the railroads are strictly regulated; and motor-vehicles, in view of the fact that they use the public highways as their right of way, do not bear their proportionate share of the tax burden. The remedy called for by the railroads is a rational division of traffic among the various transportation agencies, to be arranged by conferences attended by representatives of railroads, automotive operators and users.

These statements are contained in a reply just published by the five important railroads of France to the government demand for their consolidation. The railroads' manifesto also contains other proposals for their rehabilitation.

Several conferences of rail and highway transport representatives have already been held, with the object of effecting coordination in the business of passenger and goods carrying. Proposals made include the substitution of motor-vehicles for secondary railroad lines, the establishment of collection centers to secure for scattered shipments the advantages of car-load transportation and the systematic use of containers in store-door delivery.

Pour la Liberté de la Route et du Rail

By Gabriel Bonnet. Published in *La Vie Automobile,* Dec. 25, 1932, p. 634. [H-4]

Strike the shackles from the railroads, free them from all but indispensable governmental regulations, let them manage their affairs precisely as any other commercial enterprise and not as a public service. With the motor-vehicle available, the railroads no longer hold a monopoly in the field of transportation. They should be permitted the privileges of free competition, to discontinue such lines as are not profitable, to replace the steam locomotive with motor-vehicle or rail-car where this is expedient and to fix rates according to the cost of the service rendered. The motor-vehicle should be permitted a like degree of freedom, so that the rule of survival of the fittest shall prevail in transportation as in other branches of industry.

These are the conclusions drawn from the author's analysis of the much-discussed railroad situation in France, in which he refutes the opposite theory, the more stringent regulation or even total absorption of the railroads by the state.

MOTORCOACH

Road Impact Produced by a Heavy Motorbus

Reported by James A. Buchanan. Published in *Public Roads,* November, 1932, p. 137. [J-1]

Determination of the magnitude of the impact forces exerted on the pavement by the wheels of motor trucks and busses has been the object of an extended series of investigations by the Bureau of Public Roads, in cooperation with the Rubber Manufacturers' Association and the Society of Automotive Engineers. In the course of these investigations the major factors which affect the magnitude of such impact reactions have been separately and collectively studied both in the field and in the laboratory. In order to round out this research a final series of tests has been made with a bus chassis capable of carrying heavy loads at high speeds, to anticipate, in some measure at least, the trend in operating conditions for several years to come.

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NOTES AND REVIEWS

Continued

This series of tests was planned with three objects in mind. First, data were desired concerning the magnitudes of the impact reactions produced at high operating speeds and the relative magnitudes of the shock and drop types of reaction throughout the full range in speed represented by modern operating conditions. Second, more complete data were desired concerning the magnitude of the reactions developed by a considerable number of severe but typical roughness conditions occurring on the surfaces of highways in actual use. Third, data were desired concerning the relation between the magnitude of reaction and the frequency of occurrence for the full range of surface roughness of highways. The data obtained in these tests and the conclusions drawn therefrom are presented in this report.

Motorbus Transportation

By the International Correspondence School Staff. Published by the International Textbook Co., Scranton, Pa., 1930-1931. Four Volumes, 194 pp., illustrated. [J-4]

The four volumes in this series cover a wide variety of problems connected with motorcoach operation. Book I covers the Motorbus and Traffic, The Bus Operator, and Motorbus Laws; Book II, How to Increase Bus Patronage, Problems of Bus Maintenance and Motorbus Financial Problems; Book III, Selection of Bus Equipment and Gas-Electric and Other Buses, and Book IV, Motorbus Management Problems and Handling Motorbus Personnel.

MOTOR-TRUCK

Motor Truck Freight Transportation

Domestic Commerce Series No. 66. Published by the U. S. Department of Commerce. Government Printing Office, City of Washington, 1932; 59 pp., illustrated, price 10 cents. [K-4]

This bulletin reports the results of a survey of intercity motortruck freight transportation for hire, conducted in 1931 jointly by the Bureau of Public Roads of the U. S. Department of Agriculture and the Bureau of Forign and Domestic Commerce of the U. S. Department of Commerce. The principal objects of the investigation were to secure available data on (a) motor equipment in use, particularly as to types and weights of vehicles, (b) radius of haul, and (c) costs of operation.

PASSENGER CAR

The Paris Automobile Show

Published in *The Automobile Engineer*, November, 1932, p. 529. [L-1]

This article giving a survey of the trend of design in continental Europe as portrayed at the Paris Show, comments particularly on the increasing adoption of independent wheel suspensions; improved frame designs and the very general adoption of a large central X-member in place of orthodox cross-members; and increased normal running speeds of the average engine, particularly the small power units.

Individual exhibits are covered in detail and a separate section on bodywork is included.

Comment Se Pose le Problème Automobile

By Emile Claveau. Published in *Journal de la Société des Ingénieurs de l'Automobile*, December, 1932, p. 1956. [L-1]

Automotive design is at the dawn of a revolution which will completely overthrow conventional theories. So says Emile Claveau, who was responsible for one of the unusual models exhibited this year. The development stage of French industry justifies this conclusion, since it has passed the evolution of the horseless carriage, the war time crises, and the subsequent industrial adjustment to large scale production. French engineers are prepared to turn their minds again to technical design problems, as is evidenced by the many novelties at the show. Finally the present condition of the automobile, a heterogeneous and irrational collection of organs each perfect in itself, calls aloud for improvement.

In obeying his own precept, to cease merely modifying the previous year's chassis and to begin anew from the very foundation to design a vehicle to meet automotive requirements, the author developed a streamlined car, low-powered, of low weight, metal construction, with unit engine and transmission driving the front wheels, independent-wheel suspension and independent steering for each wheel. He explains why he abandoned the rear engine-location of his previous cars and his ideas of practicable and effective streamlining.

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NOTES AND REVIEWS

Concluded

L'Aérodynamique Rationnelle dans l'Automobile

By George W. Ivanow. Published in *La Technique Automobile et Aérienne*, 4th quarter, 1932, p. 97. [L-1]

Research manager of a Belgian aircraft firm, the author surveys passenger-car forms from an aerodynamic viewpoint and finds them illogical and replete with design heresies no longer tolerated in the younger branch of transportation, aviation.

He summarizes the findings of previous investigators on the savings in power and fuel to be attained through streamlining, and analyzes various streamlined cars by comparing them with an ideal aerodynamic form. Among the models described are a Rumpler, Wichterlé and Kovarik, Maybach, Claveau and the creations of Sir Denistoun Burney, to which highest praise is given.

The designs analyzed fall into two classes, those in which a streamlined body is superimposed on a conventional chassis and those in which the chassis and body as a whole are conceived with a view to reconciling structural requirements, comfort, ease of manufacture and minimum wind resistance.

Selected Papers from Purdue University Automotive Service Conferences 1929-1930-1932

Compiled and Edited by H. M. Jacklin. Extension Series 29. Published by the Engineering Extension Department, Purdue University, Lafayette, Indiana, January, 1933. [L-2]

In an effort to contribute to improved service methods in Indiana by providing a conference for open discussion of the many complex problems that have presented themselves in automotive care, Purdue University has held three automotive service conferences.

The material is divided into two parts: Part I includes papers of a general nature and of particular interest to the garage owner or service superintendent; and Part II is devoted to the discussions on the servicing of particular units of vehicles.

Can a Transmission Have a Brain?

By S. O. White

Chief Engineer, Warner Gear Co.

S. O. White

PROBABLY no man in the automotive industry by reason of his experience, his reputation and his technical background is better entitled than S. O. White to have opinions on the outlook for automatic transmissions.

Mr. White expresses his opinions on this subject briefly, frankly and firmly in this article.

Even those engineers and executives who disagree with him—and there may be many who do—will find, in his outspokenness and clarity, stimulation and assistance in meeting the pressing current problems regarding automatic transmissions which face a number of automotive concerns directly or indirectly.

Mr. White is chief engineer of Warner Gear Co. and is a member of the Council of the Society.

This article was written exclusively for the S.A.E. JOURNAL. Further comment and critical discussion of the important topic it treats will be welcomed.

THERE is a great deal of loose talk these days about automatic transmissions. Now and then a newspaper story appears describing in very general terms some new device that is about to revolutionize the industry; but for some reason the revolution does not start.

Just what is an automatic transmission?

How automatic should it be?

What will it do?

Why does anybody want one?

Will the public like it after it gets one, and after the novelty has worn off?

Whoever has the right answer to all these questions will be a long jump ahead of the industry.

Answering the first question, a prominent executive who was of practical turn of mind, without attempting to be facetious, said, "A satisfactory automatic transmission is one that operates smoothly, quietly, without effort or skill on the part of the driver, and does the right thing at the right time."

I do not believe any one has seen such a device, as yet. It means that the transmission needs a brain.

As to how automatic an automatic transmission should be, we find a great difference of opinion. Often the opinion is just personal, too, and not based on experience.

We have had the opportunity of driving a good many different cars equipped with transmissions that might be called more or less automatic. We have concluded that a fully automatic transmission will not be acceptable, as it has no brain, and therefore can not do the right thing at the right time. It is not equal to every emergency of modern traffic, or to the widely varying driving requirements and habits of different drivers. The fully automatic device is sometimes quite delightful to handle at first, but on more extended use, and after the first thrill is gone, its disadvantages begin to appear. Usually car performance and emergency control, or responsiveness, suffer. Sometimes new peculiarities appear which are annoying or troublesome.

We believe it is necessary to leave a certain amount of control at the instant disposal of the driver. Just how much control is again a matter of opinion. For a fully automatic device, arrangements could be made whereby the driver could overrule the automatic control at will, and secure certain definite reduction ratios.

The possibilities in this direction are affected greatly by the nature of the design, and by whether it has definite ratio steps, as through gearing, or is provided with infinitely variable ratios. They also depend on the nature of the automatic control. This is usually governed by the speed of the car, the speed of the engine, or the torque requirements, and combinations of these three.

Design Possibilities Varied

It may be gathered from the foregoing that there are many ways to make a more or less automatic transmission, and I can assure you that there seems to be no limit.

A favorite method of attack has been to start with an approximately conventional gear box and add automatic controls. This has the advantage of being less upsetting to existing tools and methods of manufacture, of involving less new and radical principles, and, in some cases, of less change in driving habits. It can be varied widely as to the amount and kind of control left to the driver. Since no one can predict the public reaction to automatic transmissions, this might be a good place to start.

Much development work has been done on mechanical gear shifters, and although several have been made to work very well, the driving results do not warrant the amount of mechanism involved. Starting with a mechanical gear shifter, a number of devices have appeared for operating it automatically. This only adds to the complications and we have not seen any device of this kind that is very hopeful.

The most popular idea has been to apply to an approximately conventional geared transmission, some form of governor which will shift gears at certain road speeds. This may be satisfactory, if sufficiently controlled and reduced to a fairly simple and inexpensive mechanism.

I might here outline a few operating fundamentals that apply rather generally, and which most inventors do not seem to realize. It is necessary that the driver be able, at will, to stay in a given ratio over a very wide range of road speeds. This is particularly true of second, where it may be necessary to stay in that ratio while accelerating up to 40 or 50 m.p.h. On decelerating, the ratios should change at lower road speeds than they did going up, unless the speeds going up were rather low. Also, the drop back should be from high to second and not high to first. This may put first and second so close together as to be very uncertain of accomplishment.

When driving in traffic it is desirable to stay in high most of the time, and second the rest of the time. We had quite a little experience with a rather smooth working device, which, however, unless very expertly handled as to throttle opening, would drop back to low whenever the car drifted below 18 m.p.h., as when coasting along in slow traffic, or slowing to turn a corner. Then, on accelerating, there would be quite a "revving up" of the engine. This was one of those things which was not very apparent at first, but, after an all day session with this car, the frequent and unexpected engine rushing got on the nerves and became very annoying. From many tests, with various kinds of drivers it appears that the transmission should drift out of high speed at about 10 miles an hour. This is somewhat a matter of opinion and might be 8 or 7 for some drivers.

The question will at once arise, "If a car is losing headway on a grade, who wants to wait until it slows to 10 m.p.h. before second is automatically picked up?" This is one of those places where the brains of the transmission are not equal to the demand. One answer would be to combine a torque reaction control with the road speed governor. This gets quite complicated and is still apt not to give you just what you want, when you want it.

A more flexible and practical solution appears to be to provide a convenient manual or foot control, by which the driver can overcome the automatic control at will and secure second at any road speed whatever, keeping it until he is ready to return to high. This very thing is one of the features of the Banker Mono-Drive transmission, described in Walter C. Key's paper at the S.A.E. Annual Meeting in January, and also in the Feb. 18 issue of *Automotive Industries*.

The Mono-Drive has an automatic centrifugal clutch and does not need a clutch pedal. Second speed control is, therefore, attached to what would ordinarily be the clutch pedal. A light pressure of the foot secures second speed at any time and keeps it as long as the pedal is depressed. On releasing it, the transmission is at once in high, unless in the meantime the car has slowed down below the road speed for which the second speed governor is set.

"As to how automatic an automatic transmission should be, we find a great difference of opinion.

"Often the opinion is just personal, too, and not based on experience.

"We believe it is necessary to leave a certain amount of control at the instant disposal of the driver. Just how much control is again a matter of opinion. For a fully automatic device, arrangements could be made whereby the driver could overrule the automatic control at will, and secure certain definite reduction ratios."

This action is accomplished by an overrunning clutch. Some kind of overrunning clutch is to be found in the majority of automatic designs. You may be interested to learn that this fact had a great deal to do with the introduction of free wheeling. Our early study of certain types of automatic transmissions which required a one way clutch led to a closer acquaintance with what had been done on the Continent and in Great Britain, with overrunning clutches and free wheeling, which, as you may know, is an English term.

At that time, automatic transmissions looked very complicated, very far away, and doubtful of public acceptance, partly because of expense. We therefore concentrated on the overrunning clutch and free wheeling, postponing the automatic transmission to a later time.

The presence of one or more overrunning clutches in automatic transmission may mean that the car free wheels in certain speeds without any control from the driver. In certain states the laws compel all free-wheeling cars to be equipped with means for locking out the free wheel, making it illegal to coast down a mountain road. To add a manual lock to the overrunning clutches may kill the automatic action and add to the complication of the mechanism. However, in some constructions this can readily be done.

The automatic control of speeds and the question as to how much control is partly, also, a question of how much expense. A very satisfactory compromise would be a combination which is manual for first and reverse—the first being only an emergency and parking speed—and automatic for second and third with a manual control for securing second at will, after having advanced to high.

The conventional manual control is very desirable between first and reverse, for parking and handling in close quarters, as in a public garage. The automatic governors usually are not quick enough or smooth enough to equal hand manipulation for these purposes. This also saves a considerable amount of mechanism, weight and expense.

It is not possible within the limits of an ordinary article to do justice to, or even attempt to describe the many types of devices that have been proposed. Most of them are quite impractical and of those that actually function, most of them are too complex and expensive.

I feel that I must, however, touch on the hydraulic type. It has been a veritable "will-o'-the-wisp" for inventors for years past. A tremendous amount of useless and unscientific work has been done by the uninformed. This type usually consists of some form of pumping device with or without gears, and throttling means for varying the flow or pressure. Most fall into the great class known as "slipping clutches" and possess no qualities of torque increase. Some are of the turbine type, and where the reaction is taken against a stationary member anchored to the engine or frame of the car, torque increase is possible. There are, however, always serious problems of leakage, loss of pressure, heating, variation of viscosity of the fluid medium and loss in efficiency. A direct drive is usually impossible, as the pumps or turbines have to be working to drive at all and there is either a constant slip, or some governor device to throw in a mechanical clutch for direct drive. The tendency is also to drop down to extreme low ratios when starting, resulting in annoying engine rushing.

These defects were recognized in one device that employed a fixed mechanical gear train for starting and a hydraulic, infinitely variable range from second to high, which at a predetermined engine speed became a direct mechanical drive by means of centrifugally expanded brake shoes.

Transmission Functions Summarized

To return now to the questions I raised at the first of the discussion, it may be seen from the foregoing what an automatic transmission will do. It should make the handling of a car somewhat easier and might be classed as a luxury. It does not appear to add much to the performance of a car except that the uninformed driver should be able to go through the speeds like an expert, and so secure a faster getaway in traffic. It certainly will add to the cost of a car and is not an economy feature.

The reason for wanting one will probably be on account of the convenience and ease of handling, the thrill of the thing, and because Henry Jones has one.

In the phrase "ease of handling," we may have the fundamental thing that the public wants and will buy. Perhaps we can get it without going so far as the automatic transmission. It may be more nearly right to provide a convenient control which can be shifted up and down the range of speeds, at any time, with finger tip ease, without skill or experience and without using the clutch foot or juggling the throttle. This must be accomplished without jerk, chatter, noise or jar in the vehicle. It would be something of a return to the control obtained a generation or more ago in certain steam, electric and friction drive designs.

This would leave the control of the car fully in the hands of the driver. One of the psychological objections to the fully automatic transmission, and one which may not appear at first, is that it robs the operator of one of the distinct pleasures of driving. This is the feeling of control or mastery over the powerful and complicated machine, which the modern automobile is, and the ability to make it perform at will, like the expert horseman putting his mount through its paces.

Another objection is a certain feeling of helplessness in an emergency. There being no control, there is nothing to do about it, but hope that the machine gets you through all right.

As to the reception and final acceptance of the automatic transmission by the public, any one's opinion is as good as mine.

Industrial Research Laboratories Listed

THE Research Information Service of the National Research Council is preparing a revision of its "Industrial Research Laboratories of the United States, including Consulting Research Laboratories", the fourth edition of which was published in 1931 and contained over 1600 such laboratories.

This bulletin is the only list of industrial research laboratories known to the compilers (Clarence J. West and Callie Hull) and is undoubtedly used by many persons, not only as a source of information concerning such laboratories but also as a mailing list for important announcements concerning new apparatus and processes and for compilations of interest to research workers in industrial fields.

In addition to the 1600 laboratories already known, it is very desirable that addititonal laboratories be listed, if such are in existence. While every effort will be made to locate such firms, it is felt that many will be overlooked unless they are called to the attention of the compilers.

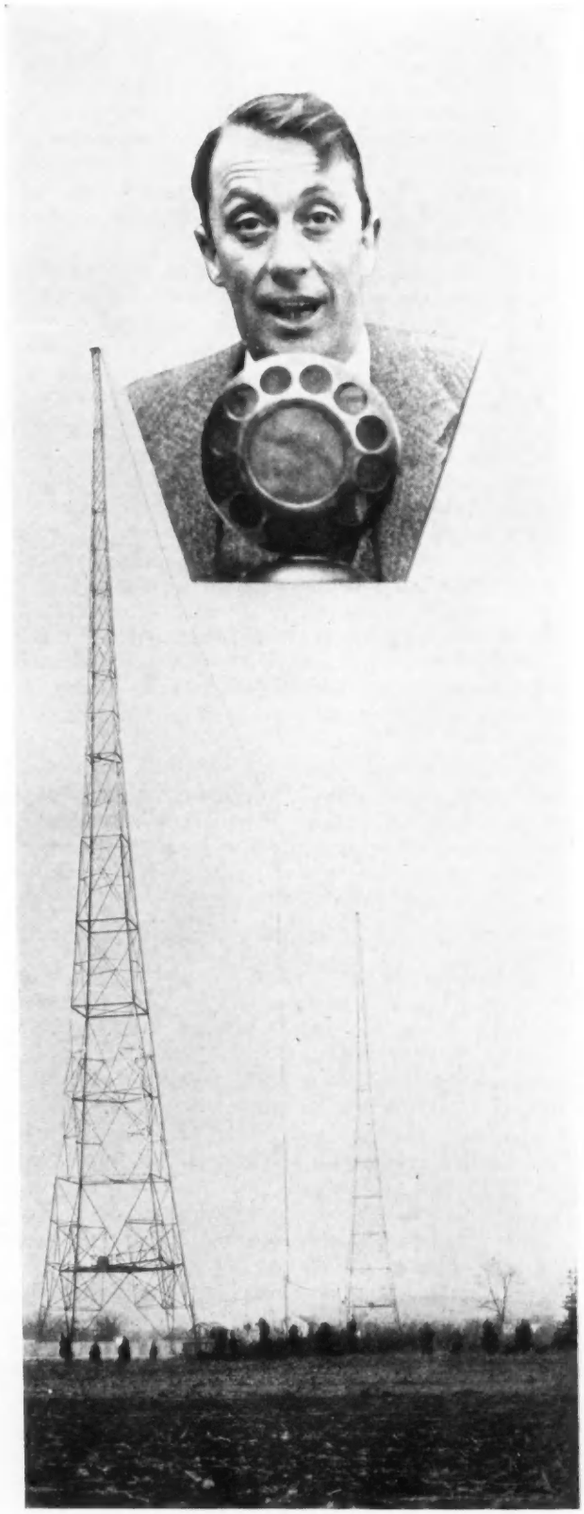
If the reader of this is a member of a firm maintaining a research laboratory and if it is not known whether the firm in question is already listed in the previous bulletin, it is hoped that a request will be forwarded immediately to the Research Information Service, National Research Council, Washington, D. C., requesting a questionnaire, in order that the forthcoming bulletin may be made as complete as possible. The listing involves no financial obligations on the part of any firm and may be of considerable value, since this publication is recognized by all familiar with it as a valuable source of information regarding industrial research activities in the United States.

The data included in the bulletin are made up of the name and address of the firms, the research directors and the research problems engaging the attention of the laboratories. There are also included an alphabetical list of research directors, a subject index of research interests and a geographical index of firms.

The bulletin will not be available for distribution before September, 1933.

Car Antenna Problems Tackled In Move to Better Automobile Radio

Other problems studied concurrently by radio and automotive groups



DEFINITE progress in the car antenna problem—said by some to be the most serious problem at present in automotive radio—is being made by the S.A.E. and R.M.A. Committees on Automobile Radio Installation.

To date these committees, acting jointly, have adopted, tentatively, the following recommendations on antenna:

A—The antenna should be mounted on the roof of the car and the antenna material should be kept a suitable distance away from the metal parts of the car body.

B—The antenna capacity, including lead-in, should be from 100 to 400 micro-microfarads, preferably 200 micro-microfarads.

C—The roof area should be clear of any grounded circuits, metal cross braces, etc. Rear quarter lights are to be recommended rather than dome lights.

D—The antenna lead-in should be composed of a suitable shielded conductor extending from the pillar post to the radio receiver. This shielding should be properly grounded to the body. The capacity and power factor of the lead-in must be low.

As previously mentioned, these recommendations of the R.M.A. Committee on Automotive Radio have been adopted tentatively by the S.A.E. and R.M.A. committees and are not yet released as definite recommendations.

Commercial means of standard and production tests of automobile antennas during the manufacturing process are now being determined by the Automobile Antenna Subcommittee. This subcommittee, which also is reviewing the entire subject of antenna, was appointed at the first joint meeting of the S.A.E. and R.M.A. committees last September. The purpose of this joint meeting and another held in January, 1933, was to consider recommendations prepared, under date of July, 1932, by the R.M.A. Committee on Automotive Radio.

At a meeting of the R.M.A. committee in April, 1933, the antenna subcommittee in an interim report discussed in some detail the measurement of capacities of car antennas. This interim report also included suggestions and questions on the following phases of the antenna problem: location, material, area, capacities, insulation, lead-in, interference, capacity and

resistance measurements, and measurements at radio frequency. The findings of this subcommittee are to be reported to the next joint meeting of the R.M.A. and S.A.E. committees.

In addition to the previously enumerated four recommendations on car antenna which were tentatively adopted at the September joint meeting, a fifth recommendation, which suggested test of antenna insulation by the use of an induction coil, encountered serious objection on account of the fire and accident hazards.

The September meeting agreed that some radio frequency test should be applied when there is a change of design to ascertain if losses were increased. Consequently the antenna subcommittee was appointed and put to work on this problem. The personnel of the subcommittee follows: Chairman, H. E. Kranz, Grigsby-Grunow Co., Chicago (A. Crossley, Howard Radio Co., South Haven, Mich., resigned), and A. A. Leonard, Philadelphia Storage Battery Co., Philadelphia, representing the R.M.A.; H. C. Doane, Buick Motor Co., Flint, Mich., representing the S.A.E.

In its initial report presented at the January joint meeting the antenna subcommittee made suggestions in regard to radio frequency test and production test for automobile antenna which are given in the following paragraphs. These suggestions were accepted tentatively, pending the findings of the subcommittee's present study. The suggestions on tests follow:

(1) A test should be made for capacity of the antenna. This is mainly a design test, as after a definite antenna is once specified, the capacity would vary only a small amount. The recommended minimum capacity for cars with rigid tops is 200 to 400 micro-microfarads, and for cars with demountable tops, 100 micro-microfarads. This test would normally be made with a portable capacity bridge.

(2) A test should be made for the resistance of the antenna. Due to the fact that in the manufacture of a car this will probably vary over considerable limits if a very close inspection is not maintained, it is desirable to make this a 100 per cent production test as this will, at the same time, indicate any grounds in the antenna system. This test should, of course, be made before the top cover is attached to the car in order that any defects found can be readily remedied at a minimum expense. A 500-volt megger is suggested.

BY getting behind the scenes with the committees, the S.A.E. JOURNAL is endeavoring to keep readers posted on progress in various committee activities.

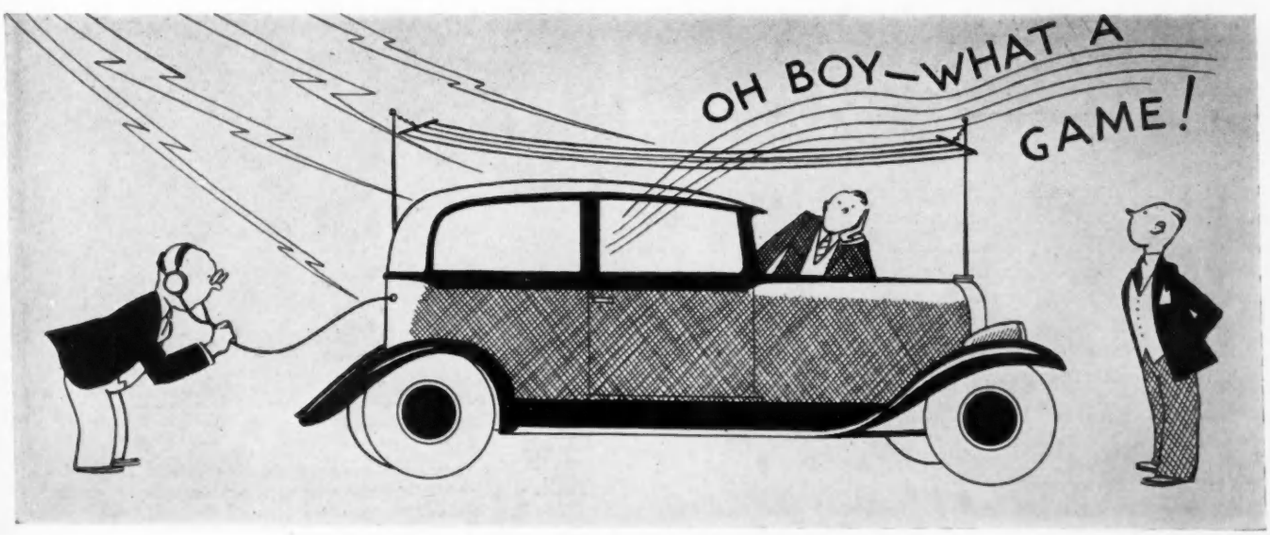
Here is what the joint effort of the R.M.A. and S.A.E. committees has produced to date on one of the most important problems in automobile radio installation—car antenna.

Other radio problems, including mounting space, ignition suppression and battery current, also are under the joint scrutiny of the R.M.A. and S.A.E. committees.

(3) It is possible to combine both the capacity and resistance test mentioned in the foregoing into a single test which would indicate the resistance of the antenna at radio frequency. A suggested circuit for this radio frequency test will be submitted in the next report.

In discussing these suggestions it was pointed out that the problem of car antenna is considerably increased by the possibility of metal tops. It was suggested also that in the measurements of antenna capacitance, the values of the antenna-ground capacitance and the car-ground capacitance were as important as the antenna-car capacitance.

In addition to the recommendations for antenna, the two committees jointly are considering recommendations of the R.M.A. committee on the following: (1) location of radio equipment; (2) mounting space of radio equipment; (3) ignition equipment; (4) ignition suppression; (5) wiring and generator; (6) battery current for radio installation; (7) sources of interference. A majority of the recommendations on the foregoing subjects were approved and adopted, in some cases with slight modifications, at the S.A.E.-R.M.A. joint meeting in January; progress on the others is reported by the several subcommittees concerned.



Are Cast Iron Crankshafts Coming on High Speed Engines?

By Thomas H. Wickenden

Assistant Manager, Development and Research Department, International Nickel Co.

Cast iron units are useful means to check crankshaft design. Production possibilities in future.

SUCCESSFUL development in production of cast iron camshafts in the last year or so has intensified interest in the possibility of using similar materials for crankshafts. Considerable experimental work has been done, in fact, on cast iron crankshaft developments and hints of wide production use have been numerous.

An iron with a martensitic structure in the cast or heat treated state is well suited for crankshaft production. Such an iron requires a low total carbon (2.25 to 2.50 per cent), low silicon (1.00 to 1.50 per cent) 3 to 4 per cent nickel and probably some chromium or molybdenum. These crankshafts have a high hardness and are unmachinable as cast. They are annealed to produce a Brinell hardness number of 300 to 320 where they are machinable and possess good strength and toughness. The high hardness of the bearings insures excellent wearing properties. A number of crankshafts have been made using these high strength alloy irons and have shown excellent results in preliminary tests as well as in engine operation.

Fatigue Resistance

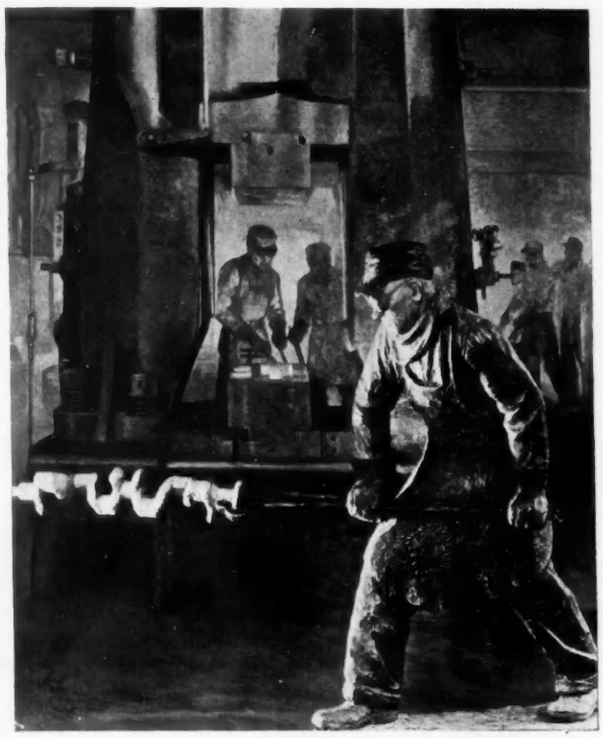
One of the main objections to earlier consideration of cast iron for crankshafts was that the material would not have a sufficient resistance to fatigue failure. A number of preliminary tests were made, in which the center bearing of a crankshaft was definitely offset 1/32 to 1/16 in. and the crankshaft operated under these conditions to failure.

To the surprise of all concerned, the cast iron crankshaft operated several times longer than a steel shaft under these conditions. These tests have led to the thought that the high strength cast irons have much higher endurance limits than steel. This is an interesting point and needs further analysis and discussion.

Rotating beam fatigue tests on steel and cast iron have brought out several interesting characteristics of these two materials. S.A.E. 1045 Steel, quenched and tempered to a tensile strength of 95,000 to 100,000 lb. per sq. in. is commonly used for crankshafts. In this condition samples run on a rotating beam fatigue testing machine will show an endurance limit of 48,000 to 50,000 lb. sq. in., thus showing an endurance to tensile strength ratio of 50 per cent. This steel has considerable ductility as measured by elongation and reduction of area, and considerable impact properties as indi-

Wood carving for General Motors Building at Chicago World's Fair

"Successful development in production of cast iron camshafts has intensified interest in the possibility of using similar materials for crankshafts."



Wood carving for General Motors Building at Chicago World's Fair

"Five years ago it would have been considered utter folly to suggest use of cast iron for either camshafts or crankshafts of a high speed automotive engine."

cated by notch impact specimens. Its hardness will be slightly over 200 Brinell.

In comparison, the special cast irons will show a tensile strength of 60,000 lb. per sq. in., elongation of between 1 and 2 per cent, practically no reduction of area, and extremely low impact values as compared with the steel. However, the materials will show an endurance limit of 30,000 lb. per sq. in. or higher, the endurance ratio being about 50 per cent, although in some cases still higher ratios have been secured. These facts make the results of the practical test of the offset crankshaft bearing more difficult to explain, and further analysis is necessary to throw light on the situation. There are several other features of these two materials which aid in clearing up the mystery.

First, the Young's modulus of steel is approximately 30,000,000 lb. per sq. in., while that of these high strength cast irons is in the order of 24,000,000 lb. per sq. in. Therefore, with the same deflection in the two shafts, the cast iron shaft would be stressed 20 per cent lower than the steel.

Both the steel and cast iron shafts were stressed considerably above their endurance limits as shown by the comparatively short life as endurance tests go. However, a comparison of S-N (stress number of revolutions) curves does not show a sufficient difference in their slope characteristics to account for the longer fatigue life of the cast iron, even when it was stressed 20 per cent lower.

Iron Less Sensitive

The final explanation is centered in the different reactions these two materials have toward stress localization by sudden changes in section or other "stress raisers," such as fillets, notches, grooves and holes. Cast iron is considerably less affected than steel by the presence of these disturbing elements. The graphite flakes in cast iron detract from its strength, and can be considered from a structural standpoint as adding voids, faults, and notches in the steel matrix. These faults are considered as the worst type of "stress raisers" when occasionally present in steel. Apparently they become a virtue when present in sufficient quantities, for cast iron shows endurance ratios on the same order as heat treated steel, and at the same time the addition of another "stress raiser" through imperfect design makes practically no difference in the resultant endurance limit. Not enough data are available to state definitely what this difference amounts to, but it is safe to say that a groove which would reduce the apparent endurance limit of steel 25 per cent would make practically no difference in that of cast iron.

Crankshaft Tests

A crankshaft, by the limitation of its design, has points of high stress concentration at each bearing and pin, where the section changes suddenly into the throw; the fillets are small, and in the steel shaft the stress concentration must be very high when the shaft is deflected 1/32 to 1/16 in. at the center bearing. This test, instead of proving that the endur-

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FACTS! Facts! Facts!—this article is full of them.

The author has brought together this information from scores of practical laboratory tests and investigations with which he has contacted in his own and various organizations.

One of the most important facts developed by Mr. Wickenden is the need for still more data before any final answer can be given as to the practicability of cast iron crankshafts on high speed engines in mass production. Cast iron camshafts, he says, have already proved themselves in many instances.

Further comment on the subject in general or the article in particular will be welcomed.

Mr. Wickenden has written a fast moving technical discussion which bears out the opinion expressed to the JOURNAL recently by the chief engineer of one of our largest passenger car companies that:

"Mr. Wickenden is an outstanding metallurgist. I believe that any message from him would be of great value to the industry in general."

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ance limit of cast iron is several times greater than steel, proves that it is less affected by "stress raisers." This is a valuable engineering feature and shows that cast iron is really more "fool-proof" than steel when applied to a design. If the design is correct the steel can be successfully loaded to a higher stress than the cast iron.

Another property of cast iron which may prove of value in crankshafts is its high damping capacity as compared to steel. This is illustrated by the ability of steel, especially a hardened steel, to ring for a long period if suspended and struck sharply, while with cast iron the vibrations are damped out immediately. This feature may prove of value in producing smoother running engines by damping out torsional and other vibrations; however, this advantage is partially offset by the effect of the lower modulus permitting greater deflection for a given applied force.

While high strength alloy iron crankshafts have not yet been adopted in automotive production, there are a great number of cars and engines containing these shafts under operation. This type of shaft is being used on slower operating engines and pumps. It has pointed the way to an easy method of checking crankshaft design for experimental engines before expensive forging dies are made.

While use of cast iron for crankshafts still is very definitely in the experimental state, the fact that alloy cast iron camshafts are in production today is a high tribute to current progress in cast iron metallurgy. Five years ago it would have been considered utter folly to suggest the use of cast iron for either camshafts or crankshafts of a high speed automotive engine.

While cast iron has been used for various types of cams for a great many years, most of the appplications have been on relatively slow speed machinery as compared with the modern automotive engine. Such cams were made from gray iron with an attempt to adjust the composition to give the highest machinable hardness. A great deal of trouble was experienced in manufacture and machining, for with plain iron there is a very delicate balance between high hardness and machinability. The solution of this problem by the use of nickel alloy cast iron was one of the early successes of the alloyed material.

By use of approximately 3 per cent of nickel it was found possible to produce cams with a Brinell hardness in excess of 250 which were free from hard spots and machinable without difficulty. Tests on these cams showed improvements in wearing properties of many fold, which suggested the possibilities for other applications of the alloyed cast iron.

While the possibility of using cast iron in automotive camshafts has been particularly attractive from the standpoint of reducing manufacturing costs, actual service tests have shown definite operating advantages, and particularly a superior resistance to wear.

The production of a steel camshaft involves an expensive series of operations including forging, rough machining, copper-plating, finish-turning, carburizing, hardening, straightening and finish-grinding. With a cast iron camshaft, the operations consist, essentially, of casting the camshaft, machining gears or mountings for gears and grinding the bearings and cams.

Special Requirements

A camshaft must have good strength, stiffness to prevent excessive bending between bearings, and excellent wearing properties, particularly at the tip of the cam, which is subjected to a combination of high pressure and rubbing action. At the same time, certain points must be machinable, and the metal is required to have considerable toughness to prevent breaking of the shaft by unusual service or abuse.

These requirements can be met with cast irons produced by several different methods. High strength and toughness are secured in a superheated electric furnace iron having a low total carbon and containing alloys. There are three methods of manufacture being considered, and the composition of the iron is varied in each case to meet the individual requirements.

One method is to cast the cams in sand molds, inserting chill blocks at the points of the cams so that these points of high pressure will have a thin layer of chilled, white iron to resist wear. The chill depth is regulated by varying the nickel and chromium content. The presence of both elements increases the hardness of the chill.

The distributor gear blank, bearings and timing gear mounting, because of their slower cooling in the sand, will come out machinable, but an iron with sufficiently low total carbon and alloy additions to give a strength of 60,000 lb. per sq. in. and a compressive strength of 150,000 lb. per sq. in., will have a hardness around 300 Brinell. A typical composition for this method of manufacture is:

T. C.	Si.	Ni.	Cr.	Mo.
2.80	2.00	0.75	0.20	0.75

A second method is to sand-cast the cams, using an iron with a sufficient alloy addition to develop a hardness of approximately 360 as cast. This requires low total carbon (2.25 to 2.50 per cent) low silicon (1.00 to 1.50 per cent), 3 to 4 per cent nickel, and possibly some chromium or molybdenum. These cams are annealed for machining followed by reheating and hardening to over 400 BHN.

The third method is built around the use of a permanent mold casting machine. The composition and casting conditions are regulated so that the iron comes out with a thin layer of white chilled iron. In order to keep certain sections machinable, a dry sand core is inserted in the mold at these points. This retards the cooling and results in gray iron. By this means the cams and bearings will come out with a hard chilled surface, while the parts requiring machinability will develop a hardness of between 250 and 300 Brinell.

THE truck driver is the one who, more than any other influence, should be credited with the general trend towards safety in sales fleets, says the National Safety Council. In fleet after fleet, according to the Council, salesmen continued having accidents while truck drivers were beginning to achieve splendid safety records.

Investigation revealed that the good records of the truck fleets were the direct results of safety educational activities, whereas the sales fleet records were poor because few (and in most cases no) remedial measures were being taken. Accordingly, employers throughout the country have been hastening to establish safety programs in their sales fleets that will improve accident experience, as has been the case in truck fleets.

To help sales fleet operators and others with fleets of company automobiles, the National Safety Council is announcing a new service specifically designed for salesmen-drivers. The outstanding feature of the new sales fleet safety program is an award for safe driving in the form of a token or pocket-piece.

Chronicle *and* Comment

By
Norman G. Shidle

WHEN encouraging sales figures continue for nearly two months after more than three years of consistent discouragement, even a technical publication is entitled to step out of its regular path to join in the general expressions of hope.

The automobile business has improved during the last two months. Most executives now look forward to a second half business definitely ahead of the low records set in the last six months of 1932. We find these men conservative in their optimism and strongly disinclined to predictions, but one cannot contact them today without sensing a quietly sincere belief that the worst is over. This feeling is fairly general, though the continued influence of seasonal trends is recognized and an unbroken upward movement is scarcely expected.

In scores of engineering departments there is a profound hope that the sales departments are right this time in their optimism. Not only do engineers see renewed hope for personal progress in increased sales, but also they see chances for revival of development programs long cramped by the limitations of economic necessity.

SOMEBODY must be in favor of state and national legislation to compel the blending of alcohol with gasoline; otherwise there could not be such a vigorous fight as has been going on for some months past. We find little but opposition to the idea in automotive and allied circles from both technical and economic standpoints, especially the latter.

Farm groups, whose members such legislation is designed to favor, are divided in opinion, many agriculturists realizing that the farmer will have to pay higher prices for gasoline of which he himself is a large consumer, while President J. A. Simpson of the National Farmers' Union says: "It would be discrimination to say to the farmers who have oil beneath the surface of their farms that, we will, by legislation, cut off the market for a certain per cent of their oil."

The A. P. I., in a clear exposition of the technical and economic aspects of the proposal, aptly refers to it as "a disguised and highly expensive method of burning corn."

"ALMOST any ordinary driver of an automobile could tell the motor car manufacturer some startling things about his present unsuspected opportunities to serve the public better, to his own incalculable profit, but the manufacturer would not believe a word of it because he has so largely lost touch with his market.

"Out of his own technique he has evolved a convenient but fictitious notion of what the public is and wants, and that idea designs his product and tries to sell it."

Thus speaks Wilson Follett in *Harpers* of March. To part of his blunt statement most of us will agree. Almost any driver could tell the car maker of opportunities to serve the public better. We doubt that the average owner, however, could tell of many startling ways by which these new services could be turned into profit. The car manufacturer and his technical men suspect a good many opportunities to serve the public better, but the difficulty lies in turning those suspicions into certainties.

A good many engineers, nevertheless, are in agreement with the idea that more consumer research of a really scientific sort might definitely change executive ideas about what the public is and wants.

PLENTY of experimental work still is going on in connection with cast iron crankshafts. Rumor persists that new, small Ford will embody this construction.

One of the questions that will arise eventually is, "When is a cast iron crankshaft a cast iron crankshaft?" Where does steel begin and cast iron leave off, in other words. Dividing line is usually considered to be at about 1.8 carbon content. Some of the leading experimenters have already lowered the carbon content to 1.20, rumor says, although other characteristics such as silicon content, remain those of cast iron.

Despite strong belief in some quarters in efficacy of cast iron crankshafts, at least one prominent metallurgist who has done a great deal of work in this field is convinced that we aren't yet ready for widespread practical applications. "Cast iron crankshafts may be suitable in experimental work," he says, "where cost of making forgings would be high, but I can't see broad practical applications in the automotive industry at present. Besides," he adds, "it is quite possible that the cost of a satisfactory cast iron shaft—when melted in the electric furnace and with the cost of the alloys—will be nearly as high as that of a production steel shaft. Investigations of one vehicle manufacturer tend to indicate just that thing, in fact."

Others will have other opinions, but the above comes from a technician of sufficient authority to make it of very real significance.

Seven S.A.E. Past Presidents Feature

Roll of Big Names on International Engineering Congress Program

WITH final word still to come as regards many prominent foreign, as well as domestic, speakers, the tentative program for the Society's huge International Automotive Engineering Congress to be held in Chicago, Aug. 28-Sept. 4 bristles with important names—names of men who already have accepted invitations to speak.

Seven out of 18 living past presidents of the S.A.E. are scheduled either to preside at sessions or to talk before the Congress.

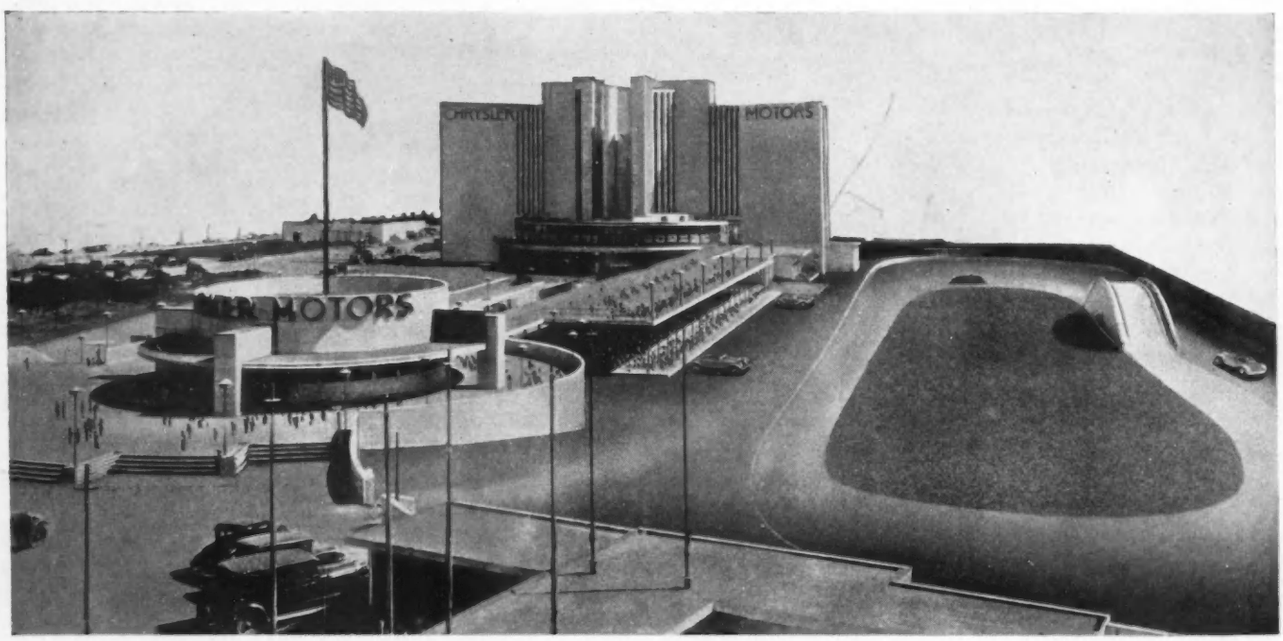
Charles F. Kettering will give his personal opinions about the engineer's place in the future economic picture. B. B. Bachman will go into the factors controlling brake design when he leads off the brake session tentatively scheduled for Tuesday morning, Aug. 29, while at the same session David Beecroft, New York manager of Bendix Aviation, and present S.A.E. treasurer, long a leading authority on legislative matters as related to automotive equipment, will talk on "Legislative Requirements with Respect to Brake Effectiveness" and will analyze the various brake codes which have been developed.

Past presidents who will participate in the Congress as session chairmen include Henry W. Alden, H. L. Horning, E. P. Warner and A. J. Scaife.

Prominent among Society members who will address the Congress is W. B. Stout, famous designer of airplanes and motor cars. He is scheduled to discuss the future of individual transportation at the passenger car session projected for Friday morning, Sept. 1.

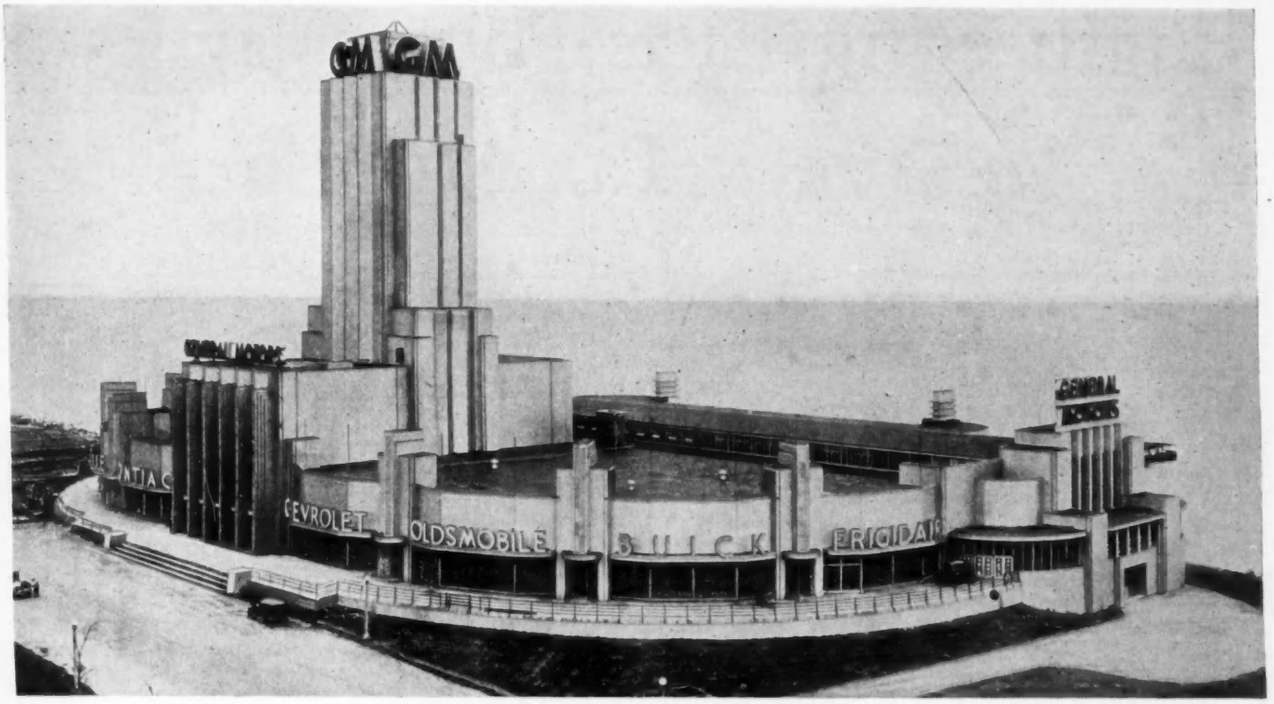
Another nationally known figure whose acceptance has been received already is President E. C. Elliot of Purdue University. He is to be Kettering's running mate on the Friday evening, Sept. 1 program.

Despite reluctance of the meetings committee to publish the names of probable foreign speakers until acceptances have been received, news of one invitation which has leaked out will be of real interest to everybody. Laurence H. Pomeroy,



"The World's Largest Showcase"

Both floors of the Chrysler World's Fair building are constructed with glass side walls, giving it the aspect of a huge showcase. The Chrysler exhibit covers seven acres and has four main parts: (1) a revolving cyclorama, depicting an airplane trip from coast to coast; (2) a 360-ft. promenade leading to the main building; (3) an exhibit of more than 25,000 automotive articles in the building itself; (4) a quarter-mile hard surface oval track which will be operated as a proving ground during the Fair.



Fair Building Houses Assembly Line

A room 420 ft. long by 90 ft. wide inside this General Motors exhibit building houses a complete assembly line on which 25 to 30 Chevrolets will be built every day during the Century of Progress exhibition. In the entrance salon are six life-sized carved wooden figures of workmen performing typical automotive operations. Complete lines of cars will be exhibited in the showrooms which encircle the outside of the building. There will be an elaborate research display.

managing director, Daimler Co., England, is coming over to talk on the subject, "What is the Matter with American Motor Cars?"

Mr. Pomeroy has been a member of the S.A.E. since 1919 and spent a number of years in this country as consulting engineer for the Aluminum Co. of America. He was a colorful participant in scores of technical discussions at Society meetings during his years in America. The brilliant debate between Mr. Pomeroy and past president Henry M. Crane over four-wheel brakes at the Spring Lake summer meeting in 1923 is still vivid in the memories of all those who packed the meeting room on a fearfully hot day to hear it. The combination of Mr. Pomeroy with so provocative a subject has already engendered in the minds of many members visions of a great session.

While details in multitude remain to be settled, broad outlines of the sessions' programs already have been fully developed by the various activity meetings committees in whose hands arrangement of the individual sessions rests. In some instances, even the details have been decided upon. Practically every branch of Society activity is represented in the striking program which is being developed under supervision of the national meetings committee.

Transportation

The motor truck and motorcoach and the transportation and maintenance groups are cooperating in program development as usual. Unless present plans are changed, a session on military motor transport will open the Congress on Monday morning, Aug. 28, with Major H. A. Nisley, chief of the automotive section, manufacturing service, U. S. Army Ordnance Dept., reviewing developments in automotive ordnance apparatus and Lt.-Col. Brainerd Taylor, commanding officer, U. S. Army, quartermasters corps, Holabird depot, telling of the automotive equipment used by the Quartermasters Dept.

The Bachman and Beecroft papers, previously mentioned, constitute the motor truck and motorcoach session on brakes, scheduled for Tuesday morning, Aug. 29, while both the automotive and railroad sides of the motor transport legislative and regulative situation will get attention at the session sponsored by the transportation and maintenance activity on the same evening. F. C. Horner, General Motors' transportation expert, will present the automotive angles, while Daniel Willard, president of the Baltimore & Ohio Railroad, has been invited to represent the railroad point of view.

The final exclusively transportation and maintenance session will be under the chairmanship of J. F. Winchester, vice-president for that activity, and coordinator and supervisor of motor equipment, Standard Oil Co. of N. J. The session will take the form of a brief symposium with both Clinton Brettell, supt. of garages, R. H. Macy & Co., and L. V. Newton, automotive engineer, Byllesby Engineering & Maintenance Corp., describing, from the operating standpoint, how economies in motor vehicle operation can be effected.

Two production sessions, one planned for Monday morning and one for Tuesday morning, Aug. 28 and 29, will deal with shop equipment and machine finishes, respectively. Joseph Geschelin, engineering editor, *Automotive Industries* will cover the first subject in a paper entitled, "Equipment Policies and Utilization of Machine Tools." Two papers will comprise the Tuesday session. F. W. Cederleaf, vice-presi-

(Continued on page 22)

Engineering Facts Point Way Out of Truck Tax Muddle

TAXATION is a matter of economics and economics is more closely akin to engineering than to politics, stated M. C. Horine in introducing the subject of the April meeting of the Metropolitan Section at the Hotel New Yorker, April 20, 1933. Treating the subject from different angles, the speakers, D. C. Fenner, Chairman of the Motor Vehicle Conference Committee and A. J. Scaife, past-president of the Society, held the interest of a representative gathering for 3 hours and provoked earnest discussion until a late hour.

In tackling the subject under the title "What's Wrong with the Laws," Mr. Fenner showed the injustice and absurdity of present methods of assessing motor vehicle taxation and submitted an engineering-economic principle harmonious with the recommendations of the American Association of State Highway Officials, which have so widely been endorsed. He said:

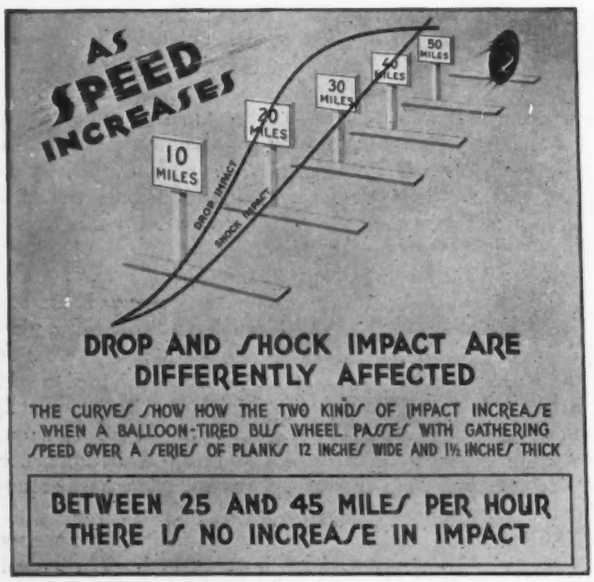
"While we can never hope to see uniformity attained in the amounts of fees and taxes levied on motor vehicles in the various states, in view of the differences that exist among them in their needs for revenue from this source for necessary highway expenditures, we are warranted in expecting, and should have, a uniform basis for the imposition of such fees and taxes."

Citing as the basis for the proposed code the results of many years of research and experimentation by the U. S. Bureau of Public Roads, Mr. Fenner introduced a series of slides reproducing the exhibit of the Bureau at the Highways Congress in Detroit last January. These slides illustrated in simple, logical sequence the analysis of the problem from the standpoint of known facts, upon which was erected a logical principle which should guide the taxing authorities in fixing equitable and adequate imposts. Six of these slides are reproduced here.

These slides showed that the four major destructive effects of vehicular traffic upon highways were abrasion, suction, shear, and impact; that abrasion had disappeared with the

Bureau of Public Roads' Posters Tell Road Impact Story

Courtesy U. S. Bureau of Public Roads



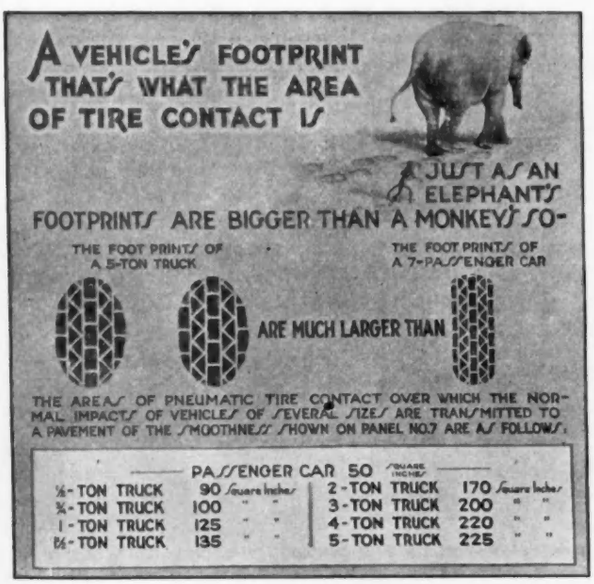
While impact is proportional to some power of speed, this chart shows that this relationship is not uniform throughout a given range of speed. Since maximum impacts are those with which we are concerned in considering the thickness of road required to sustain trucks of given weight, this chart shows that between speeds of 25 and 45 m.p.h. we may assume a fixed impact value.

Solid and cushion tires represent about 3 per cent of present equipment. Their use is confined almost entirely to cities and industrial areas. This chart shows that the impact picture at the present time has been greatly changed of late years by the prevalence of high-pressure and balloon pneumatic tires. These curves, incidentally refer to "drop" impacts, which are the maximum type.

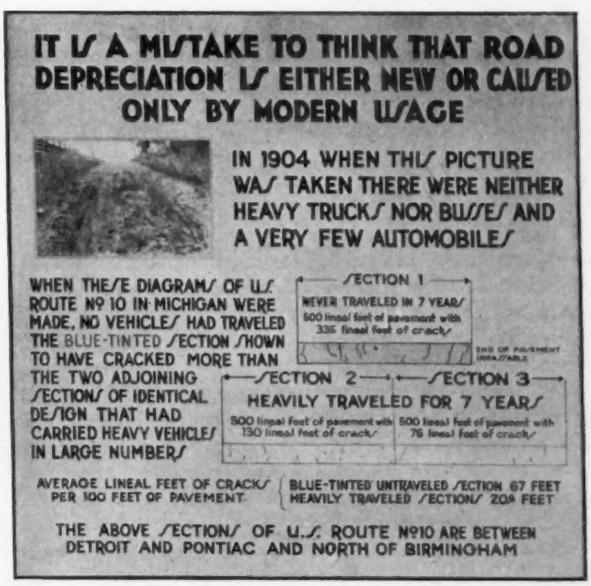
Here is shown the limited dispersion of pressure in the subgrade and stress in the pavement slab resulting from impact. The chart clearly demonstrates why the addition of axles, even if spaced the closest distance apart practicable, permits proportional increases in weight without increasing maximum pavement stresses of subgrade reaction.

Here is the conclusion from the study of impact; taxation of all types of motor vehicles can be fairly based upon an equation which properly balances extra increments of cost necessitated by extra thickness of slab to sustain successive gradations of impact from progressively heavier classes of vehicles, against the number of such vehicles registered within the taxing jurisdiction.

exit of the steel wagon tire; suction had been defeated by paving or bituminous treatment of roads; and shear was overcome by modern subgrade preparation and drainage, leaving impact alone to be dealt with. Tracing the methods and results of a long series of experiments by the Bureau of Public Roads in determination of impact effects upon road slabs and subgrades; the magnitude of impact forces developed by different weight concentrations, sizes and types of obstructions, tire equipment and speed, the slides then showed how definite conclusions had been reached. These conclusions were that with modern pneumatic tires, over roads of common smoothness, with subgrades of even the softer types, at speeds up to 45 miles per hour, the impact delivered by motor truck wheels to prevailing types of state roads are such that trucks up to 3 tons capacity can be accommodated on road structures no thicker than required to withstand climatic effects and that



This explains why adequately-equipped pneumatic-tired trucks do no more damage to pavement surfaces than passenger cars, since the area of contact increases with an increase in weight.



Some modification of this theoretical basis of taxation, however would seem warranted in view of the fact that climatic effects require a minimum thickness of slab sufficient to sustain the impacts of 3-ton trucks, even if never subjected to vehicular traffic at all, as is shown.

the heaviest trucks require roads but 15 per cent thicker, costing but 8 per cent more.

It was then shown that this extra road cost, required to accommodate the heavier vehicles, could equitably be distributed by means of special motor vehicle taxes in which all vehicles share a common base tax representing the share of each in the basic cost of roads necessary to withstand climatic effects with added increments for those of heavier weights to cover the added cost of the increased thickness of pavement necessary for each.

Following this constructively critical statement of the case, Mr. Scaife brought out in his talk "What Can We Do with the Laws?," the difficulties now experienced by both users and makers of motor trucks by reason of the illogical and erratic limitations now imposed by the states, illustrating his points with a series of slides showing the lengths to which the industry has been forced to go in special design to avoid extinction of essential heavy-duty motor transport.

"The conditions existing between the different states as to conflicting laws is analogous to a condition wherein we would have different weights and measures for each state. It will be unnecessary for me to dwell on the chaotic condition this would cause. Motor transport, especially interstate operation, is in this condition when a complete analysis of existing laws is revealed," said Mr. Scaife in summing up the uneconomic and unnecessary burden which the present legislative restrictions impose upon highway transport.

Prominent in the discussion was R. J. Littlefield, of the Pennsylvania Railroad, who energetically offered the commonly-urged railroad plea for heavier taxation.

International Engineering Congress Program

(Continued from page 19)

dent of the production activity and production engineer of Buick, will outline current practice in finishing gear teeth while a paper on applications of surface broaching also is contemplated.

Fuels and Lubricants

A session under the chairmanship of T. C. Smith, engineer, motor vehicle and construction apparatus, American Telephone & Telegraph Co., will be a joint session of the fuels and lubricants and the transportation and maintenance group.

Two authors have already accepted invitations to speak: L. P. White, Cities Service Corp., on "Why Waste Fuel Through the Exhaust?"; and J. B. Macauley, chief engineer, Chrysler division, Chrysler Corp., on "Fuel Economy from the Engine Designer's Point of View." A third paper may also be included.

Passenger Car Sessions

Two other sessions will be held under the auspices of this newly created activity's sponsorship, tentative plans placing one in the morning and one in the afternoon of Friday, Sept. 1. At the morning session there will be a symposium on cylinders, pistons and piston rings in which D. D. Robertson, chief engineer, Wilkening Mfg. Co., and several others will participate. The afternoon gathering will feature two papers, one by D. P. Barnard, assistant director of research, Standard Oil of Indiana, on stability of motor oils in service already having been definitely scheduled.

L. P. Kalb, chief engineer, Continental Motors; J. M. Crawford, chief engineer, Chevrolet, and W. T. Fishleigh will be chairman at the three passenger car activity sessions, the features of two of which have been mentioned. The third, scheduled for Saturday morning, Sept. 2, will be enlivened by a paper on engine mountings by Alex Taub, research engineer, Chevrolet, and probably by a paper on independent wheel suspension.

Vice-president Roy F. Anderson, body engineer of Auburn, will preside at the passenger car body session on Thursday morning, Aug. 31, at which two strikingly practical talks are scheduled. N. H. Manning, general manager of LeBaron Detroit Co., will discuss budgeting body construction and tool costs. Dr. F. A. Moss of George Washington University will talk about air conditioning and relative refinements for automobile body design.

Aircraft and Aircraft Engines

The aircraft crowd will have its innings toward the end of the week during the time that the important air races are to be held in Chicago. Commercial application of airships will be J. C. Hunsaker's topic at a meeting now scheduled for Saturday morning, while, at the same session, H. Foley will bring to light some new data on magnetic inspection of hollow steel propellers. Mr. Hunsaker is vice-president, Goodyear Zeppelin Corp., and Mr. Foley is with the Pittsburgh Screw & Bolt Corp.

At a Sunday morning session, R. N. Du Bois, experimental engineer, Continental Aircraft Engineering Co. and F. L. Prescott, senior mechanical engineer, materiel division, U. S. Army Air Corps, Wright Field, will be the speakers. The former will talk on high output sleeve-valve engines and the latter on high output poppet-valve cylinders.

Sunday evening will find several aircraft papers being presented, some by American engineers and some by foreign visitors. R. Rhode, National Advisory Council for Aeronautics, in his paper, will give some further information relative to flight loads.

Important foreign engineers are expected to be present to discuss aircraft engine topics at a session on Monday morning, Sept. 4, while the Congress will be closed, it is now planned by the Monday evening session at which P. G. Johnson, president, Boeing Airplane Co., will talk on "Scheduled Aircraft Operations" and J. Fry, Transcontinental and Western Air Transport Inc., will discuss maintenance of aircraft on scheduled service.

Gold Cup Racers

With interest high among automotive men in the Gold Cup races, special attention will be given to the type of boat which participates in these thrilling events, at the Marine session scheduled for the evening of the opening day of the Congress. George Crouch, internationally known naval architect, will be the speaker.

A tractor session also is contemplated during the Congress, while two Diesel engine sessions are definitely a part of the program which is being developed.

New Members Qualified

These applicants who have qualified for admission to the Society have been welcomed into membership between April 10, 1933, and May 10, 1933.

The various grades of membership are indicated by: (M) Member; (A) Associate Member; (J) Junior; (Aff.) Affiliate Member; (S M) Service Member; (F M) Foreign Member.

ADAMS, JOHN Q. (A) transportation, national accounts, Four Wheel Drive Sales Co., Clintonville, Wis.; (mail) 3-220 General Motors Building, Detroit.

BRINTNELL, W. LEIGH (A) president, Mackenzie Air Service Ltd., 704 McLeod Building, Edmonton, Alberta, Canada.

CARLSON, NORMAN E. (J) owner, Ardmore Garage Repair Shop, Chicago; (mail) 1816 Belle Plaine Avenue.

ELLIS, RAY C. (M) manager, radio sales, United Motors Service, General Motors Building, Detroit; (mail) 1408 Mayfield Drive, Royal Oak, Mich.

JONES, ARTHUR H. (A) service manager, Schebler Carbureter Co., Inc., 60 West 65th Street, New York City.

LAROWE, HAROLD K. (A) assistant purchasing agent, Dairymen's League Co-operative Assn., Inc., 11 West 42nd Street, New York City; (mail) 15-21 Caryl Avenue, Apartment 2-J, Yonkers, N. Y.

LORENZ, F. A., JR. (A) general manager, industrial division, American Steel Foundries, 410 North Michigan Avenue, Chicago.

MEVAY, FRANCIS (J) junior structural engineer, stress analysis, General Aviation Mfg. Corp., Dundalk, Baltimore, Md.; (mail) 2907 Pacific Avenue, Atlantic City, N. J.

MULIT, LLOYD H. (J) automotive research engineer, Tide Water Oil Co., Bayonne, N. J.; (mail) 461 Hoyt Avenue, West New Brighton, S. I., N. Y.

NELSON, GEORGE W., Lieut. (jg) (J) United States Coast Guard, City of Washington; (mail) U.S.S. George E. Badger C.G., New London, Conn.

ROHLOFF, DEWEY C. (M) automotive engineer, Richfield Oil Co. of California, Los Angeles; (mail) 712 Northern Life Tower, Seattle, Wash.

RUSSELL, THOMAS M., JR. (M) engineer, charge of mechanical testing, Russell Mfg. Co., Middletown, Conn.

WAIT, FRANK D. (A) vice-president, Autocar Sales & Service Co., Inc., 549 West 23rd Street, New York City.

WETHERBEE, BURTON W. (M) chemical engineer, Main Street, Cromwell, Conn.

ZIMMERMANN, FRANK A. (M) president, National Governor Corp., 611 South Western Avenue, Chicago.

Applications Received

The applications for membership received between April 15, 1933, and May 15, 1933, are listed herewith. The members of the Society are urged to send any pertinent information with regard to those listed which the Council should have for consideration prior to their election. It is requested that such communications from members be sent promptly.

BLOMGREN, OSCAR CLARENCE, owner, manager, Lorraine Garage, Winnetka, Ill.

GARTNER, W. L., owner, Gartner Brake & Wheel Service, Coffeyville, Kans.

GITZEN, J. A., president, Delta Oil Products Co., Milwaukee, Wis.

LOZANO, REYNALDO, representative, Continental Motors Corp., and Continental Automobile Co., Mexico City, Mexico.

MARA, WILLIAM A., vice-president, Stinson Aircraft Corp., Wayne, Mich.

MILLER, JOE M., mechanic (Lincoln spec.) County of Los Angeles, Los Angeles, Cal.

POWELSON, JOHN J., automotive transportation, Standard Oil Co. of N. J., Newark, N. J.

PRICE, T. G., supt. automotive, Shell Petroleum Corp., Houston, Tex.

REED, WILLIAM WALLACE, chief chemist of refinery, Wadhams Oil Co., East Chicago, Ind.

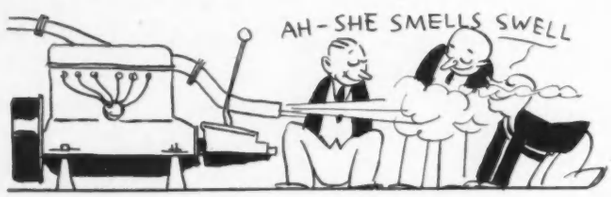
SCUDDER, NATHAN FROST, JR., aeronautical engineer, National Advisory Committee for Aeronautics, Langley Field, Va.

SIMMONS, FRANK R., shop foreman, General Motors Truck Co., Philadelphia, Pa.

Behind the Scenes With

Alcohol

THE technical aspects of alcohol blends as motor fuels are being studied by an alcohol subcommittee of the C.F.R. committee. H. L. Horning is chairman of the



subcommittee which includes: T. A. Boyd, O. C. Bridgeman, J. B. Macauley, Neil MacCoull, and T. B. Rendel.

In undertaking this work, which originated as a request from the National Automobile Chamber of Commerce, the C.F.R. committee is acting strictly as a fact finding body for the N.A.C.C.

Ice

AN investigation of the relation of fuel volatility to ice formation in the induction systems of aircraft engines is being made by the Bureau of Standards under direction of the cooperative fuel research committee. The project is being financed by the Phillips Petroleum Corp.

Although no detailed report is available at present, the C. F. R. committee states that this work is going forward.

More Aviationfuel

A SUGGESTED engine test procedure for aviation fuels has been approved by the aviation gasoline detonation subcommittee and the cooperative fuel research committee. The test procedure was drawn up by a special engine subcommittee.

Tests in accordance with the suggested procedure are to be conducted by the Wright, Pratt & Whitney, Lycoming, and Continental engine companies. The Bureau of Standards will cooperate as a fifth testing unit on an equal basis with the four manufacturers, if arrangements now being attempted are perfected by the committee.

Arrangements have been made by the special fuel subcommittee for delivery of fuels for the tests which it is expected will be started by June 15. Results will be analyzed and correlated by the following steering committee: H. K. Cummings, chairman; R. F. Gagg, S. D. Heron, W. W. White and C. B. Veal, secretary.

Pending the development of a C.F.R. Aviation Method, the cooperative fuel research committee has recommended the use of the C.F.R. Motor Method for determining octane number ratings of commercial gasolines. This recommendation has been approved by the Aeronautical Chamber of Commerce of America and it also is in line with a recent report of the special subcommittee on Antiknock Rating of Aircraft Fuels, The Institution of Petroleum Technologists (London). The report recommended that "Subcommittee No. 9 of the I.P.T. Standardization Committee be advised that the C.F.R. Motor Method with the mixture temperature adjusted to 260 deg. fahr. is the most suitable for testing aviation spirits."

This report and recommendations were subsequently accepted by Subcommittee No. 9.

Vapor Lock

INFORMATION has been obtained on fuel line temperatures in connection with the vapor lock investigation being made by the C.F.R. committee. Data have been compiled from tests made in a number of cars operated at various atmospheric temperatures. Measurements at higher temperatures will be completed as soon as the weather is suitable.

Although no preliminary report is ready for publication the committee finds that in general the temperature rise in the fuel feed system above the atmospheric temperature increases slightly at the lower atmospheric temperatures.

Plans have been made for a resumption of the vapor lock road tests in the near future using fuels of various distillation characteristics.

Colored Steel

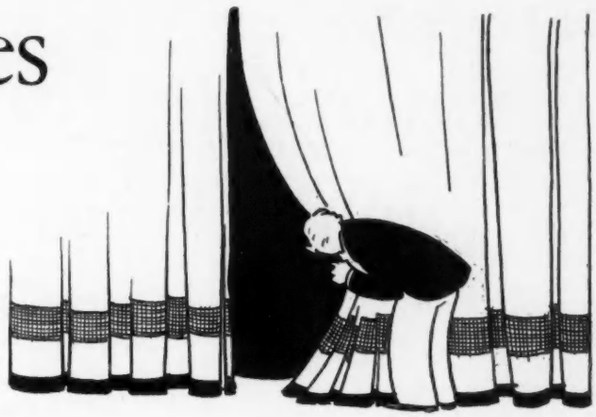
MEMBERS of the iron and steel division of the standards committee are giving their individual reactions regarding the National Association of Purchasing Agents' color code for marking steel, direct to the N.A.P.A. for consideration at its general convention in June.

This procedure was adopted inasmuch as there will be no division meeting prior to the association's convention. It is

planned to schedule this subject for further discussion at the next division meeting.

The color marking question has been considered by the division a number of times in recent years. Conclusions drawn from such past discussions have been against the adoption by the S.A.E. of any official color code as it was believed

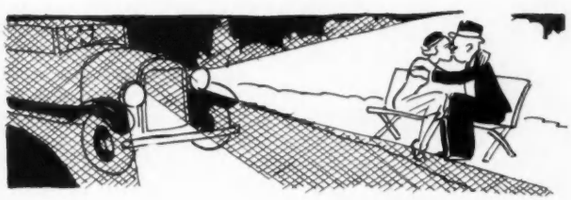
the Committees



impossible to devise such a code that was practical and detailed enough to be used generally under all the varying conditions and requirements of the industry.

Highlighting

THE S.A.E. Lighting Division, working jointly with the Illuminating Engineering Society's Committee on Motor Vehicle Lighting, has approved a new specification for automobile multiple beam headlight tests which will be the



basis for a proposed recommended practice to supplement the present S.A.E. standard.

The action was taken on May 23 following an observation road test the night before at Lake Mahopac, N. Y. The tests were made by members of the S.A.E. and I.E.S. committees, eight representatives of state motor vehicle commissioners and several others as guests of the two societies, with whom the Society has been cooperating in this work.

The new specification was received favorably when reported at the joint S.A.E.-I.E.S. subcommittee meeting on Jan. 11, but it was decided at that time to withhold final approval pending the outcome of further observation road tests.

"The new specification," to quote W. C. Brown, chairman of the joint S.A.E.-I.E.S. subcommittee, "is really a matter of squaring driving practice with driving speeds which are not only accepted but legal." Mr. Brown's subcommittee, which drafted the new specification, presented its first report to a meeting of the S.A.E. Lighting Division in Detroit, Dec. 20, 1932.

With continued development of multiple and adjustable beam lights to obtain greater road illumination and safety for modern driving speeds, there has been an increasing need for a new specification for automobile headlighting. The last revisions in the specification, up to the present, were approved by the Society in cooperation with the I.E.S. in May, 1930. More anon, probably July.

Steering

STEERING gear units should be given all the room needed for installation in the best possible way, F. F. Chandler, Ross Gear & Tool vice-president, says if operation is to be thoroughly satisfactory and maintenance is to be convenient. As a move toward this end, he suggested in a recent letter to Vice-President M. C. Horine of the motorcoach and motor truck activity, that the clearance dimensions for motorcoach and motor truck steering gears be considered for standardization.

The suggestion has been referred to members of the M. & M. T. division of the standards committee for opinions as to feasibility and desirability of setting up a standardization program which might, for example, define the limiting clearance dimensions required for the installation of steering gears, either power or manual operated.

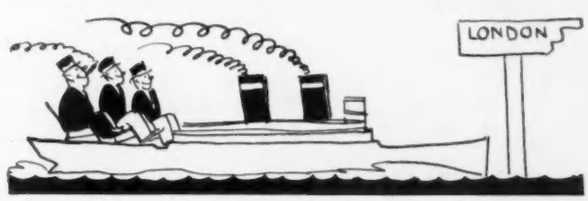
London

THE C.F.R. committee has accepted a formal invitation from the Institution of Petroleum Technologists to send representatives to the World Petroleum Congress in London, July 19 to 25, and to participate in the Proceedings of the Section on Standardization of Methods of Tests.

A. W. Pope, Jr., research engineer, Waukesha Motor Co., and Dr. R. P. Anderson, secretary, Division of Refining, American Petroleum Institute, have been designated as official representatives of the C.F.R. committee.

As a delegate of the S.A.E. Fuels Research Committee, Mr. Pope plans to give a paper on "The Measurement of Injection Engine Fuel Ignition Properties" at a joint meeting of the Standardization and the Refining and Chemical Sections of the Congress.

Two sessions are scheduled on knock rating, one on motor gasoline and the other on aviation gasoline. The C.F.R. com-



mittee has authorized reports of its detonation activities at each session. Chairman T. A. Boyd of the detonation subcommittee and Secretary C. B. Veal are to prepare a paper covering the subcommittee's work and a report on the aviation gasoline detonation program of the C.F.R. is to be prepared by H. K. Cummings, chairman of the special steering committee of the aviation gasoline detonation subcommittee.

New Data on the Bending Moments in the Master Connecting-Rod

By Prof. C. Fayette Taylor

Massachusetts Institute of Technology

SINCE publication of the analysis of bending moments in the master connecting-rod of a nine-cylinder radial aircraft engine[1], Messrs. Y. Hara, I. J. N., and N. Kanzo, post-graduate students at the Massachusetts Institute of Technology, have made a graphical analysis of the turning moments due to gas forces in a seven-cylinder radial aircraft engine having the following characteristics: Bore, 4.63 in.; stroke, 4.63 in.; length of master connecting-rod, 8.8 in.; and average radius of articulated connecting-rod hinge-pins, 2.2 in. The indicator diagram given as Fig. 3 in the original paper was used; the results are plotted in Fig. 1. On the basis of these

[1] See S.A.E. JOURNAL, December, 1932, p. 488.

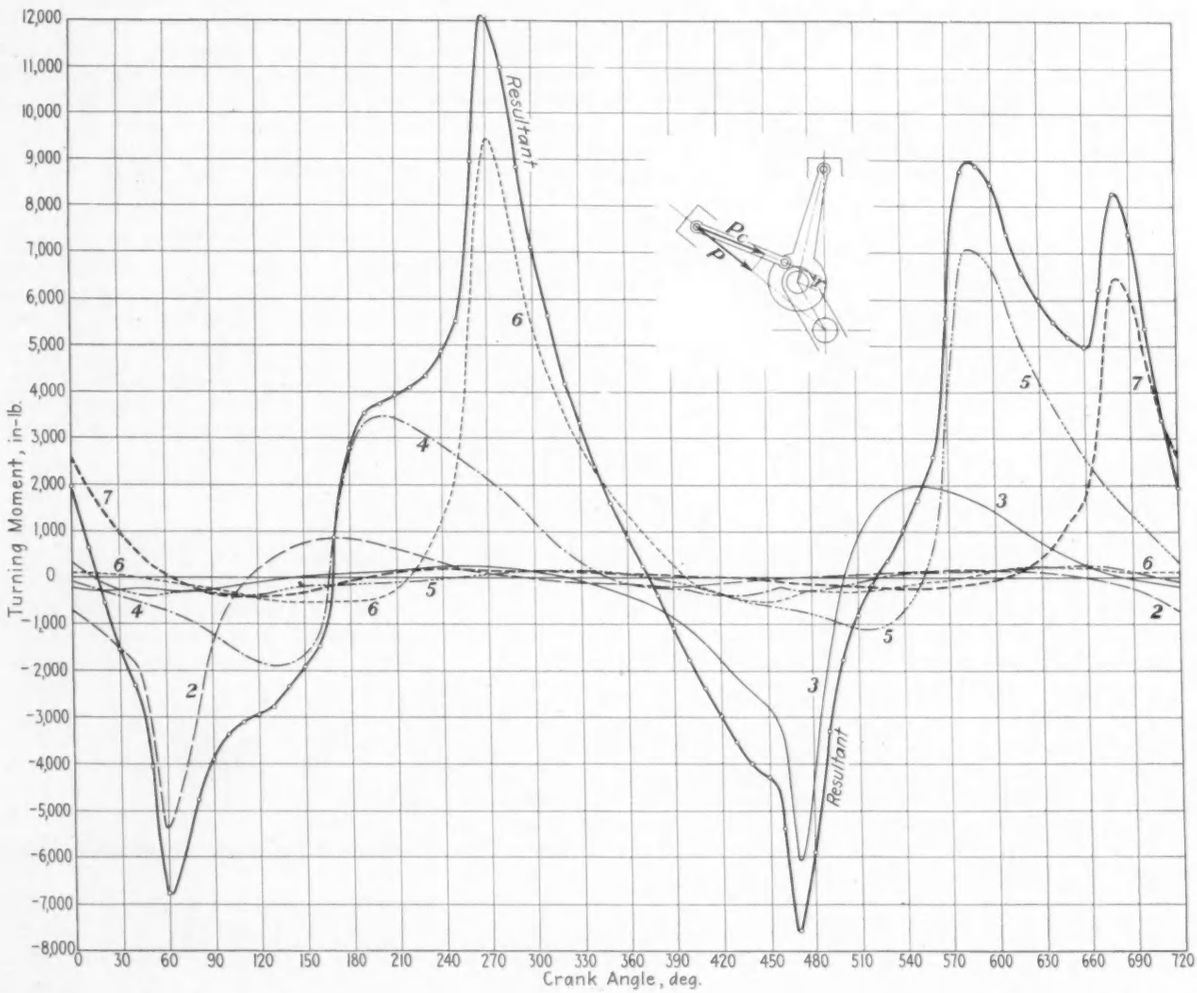


Fig. 1—Turning Moment Exerted on the Master Connecting-Rod by Gas Pressure on the Articulated Connecting-Rods, the Master-Connecting-Rod Cylinder Being Considered as Cylinder No. 1.

The engine type is that of 14 cylinders in a double row, of 4.63-in. bore and 4.63-in. stroke. The power at 2000 r.p.m. is 400 b.hp. and the L/R ratio is 3.8.

results it appears that, for a seven-cylinder engine, the maximum moment is attributable mainly to cylinder No. 6.

R. K. Mueller, also a post-graduate student at the Institute, has developed an approximate analytical formula for the turning moment exerted by an articulated connecting-rod on a master connecting-rod when the articulated connecting-rod hinge-pin angle is equal to the cylinder angle, which is the case in most radial engines. The formula[2] is as follows:

$$M = P\left(\frac{Rr}{L - r}\right)\sin\theta + \sin(\alpha - \theta) \quad (2)$$

where

M = turning moment, in inch pounds
P = total gas load on the piston, in pounds
R = crank radius, in inches
r = distance of the articulated connecting-rod hinge-pin center from the crankpin center, in inches
L = Length of the master connecting-rod, in inches
θ = crank angle from the master connecting-rod top dead-center, in degrees
α = angle between master-cylinder axis and articulated-cylinder axis, in degrees

The following tabulation gives a comparison between the moments caused by cylinder No. 6 for the analytical method of Mr. Mueller and for the graphical method shown in Fig. 1.

Crank Position, Deg.	Moment Due to Cylinder No. 6 from Formula (2), in-lb.	Moment Due to Cylinder No. 6 from Fig. 1, in-lb
260	5,750	5,970
270	9,250	9,400
280	8,500	8,600
290	6,850	6,800

The agreement is well within the probable error involved in estimating gas pressures from a typical indicator-card.

The analytical formula (2) is recommended for computations of the turning moment, wherever it can be applied. It apparently involves less labor and less chance for serious error than the graphical method. An approximation to the maximum moment for any 7-cylinder—or 14-cylinder double-row—radial engine with articulated connecting-rod hinge-pin angles equal to cylinder angles, which is accurate enough for most engineering purposes, is as follows:

$$M_{max}\ \text{(seven-cylinder)} = 1.23$$

$$P_{max} = \left[\, b^2\left(\frac{Rr}{L - 4}\right)\right] \quad (3)$$

where

P_{max} = maximum cylinder-pressure, in pounds per square inch
b = bore, in inches

This is similar to formula (1) in the previous article[2], but has a different constant.

Attention is invited to the fact that a phase error has been discovered in the gas-pressure moment-curves of Fig. 4 presented in that article[2]. This involves changes in the constants of formula (1) of that article[2], which should be corrected to read as follows:

$$M_{max}\ \text{(nine-cylinder)} = 1.14$$

$$P_{max} = \left[\, b^2\left(\frac{Rr}{L - r}\right)\right] \quad (4)$$

The maximum bending-moment occurs at 250 deg., the maximum-pressure point of cylinder No. 7, and the value of the maximum moment at this point is 8844 in-lb.

Further study has indicated that in any radial engine with articulated connecting-rod hinge-pin angles equal to cylinder angles, and with normal spark timing (maximum pressure at 10 to 15 deg. after top dead-center), the maximum moment due to gas pressure will occur when the crank is at the maximum-pressure position of a cylinder whose axis is near 270 deg. from the master-connecting-rod-cylinder axis. This "critical" crank position for various numbers of engine cylinders is as follows:

Degrees After Top Dead-Center	No. of Cylinders
250 to 255	9
267 to 272	7
298 to 303	5
250 to 255	3

Lubricants Research

AT the last meeting of the Lubricants Research Subcommittee, held in connection with the S.A.E. Annual Meeting, the Bureau of Standards was authorized to investigate the load-carrying capacity of a number of oils on the new lubricant tester, which was on display at the meeting. The essential feature of the new machine is the use of two self-aligning rolls which can be driven at different speeds, the pressure between the rolls being controlled by loading a lever arm attached to one of the rolls. This arrangement has two main advantages:

(1) The ratio between the actual pressure and the applied load remains constant throughout the run since any wear which occurs takes place uniformly around the circumference of the rolls.

(2) The oil is wedged in between the rolls in a manner similar to that which occurs in gears. Gear action is further simulated since it is possible to vary the relative amount of sliding and rolling between the two rolls.

The machine exhibited at the meeting was assembled very hurriedly and considerable work on it was necessary to put it in condition for routine operation. This work has been completed and preliminary results indicate:

(1) That the machine rates lubricants in the order of their service performance.

(2) That the results are not very sensitive to rate of loading the rolls.

(3) That seizure is very characteristic and can readily be detected while the machine is in operation.

(4) That the device which automatically maintains alignment between the rolls performs satisfactorily so that the applied load is a true criterion of the actual pressure.

This information has been obtained with rolls made of the same steels that are commonly used for hypoid gears. Accumulation of final data on load-carrying capacity under various conditions of operation is now progressing rapidly.

The progress of the work on load-carrying capacity to the point where accumulation of the desired data is now largely a matter of routine operation of the machine makes it possible to consider the second phase of the general program, namely, the investigation of wear. It is believed that work on this phase of the problem could advantageously be started at once. There appears to be two general phases of the wear problem:

(1) Wear as the result of inherently abrasive material in the lubricant, which will be evidenced under all operating conditions.

(2) Wear under heavy load conditions where the extreme pressure characteristics become effective.

Lubricants containing abrasive material appear undesirable and such lubricants could be eliminated by means of a simple test apparatus in which wear with the extreme pressure lubricant is compared with wear obtained using a mineral oil, both being run under light load. The development of such an apparatus would then form the basis for the more complicated investigation of wear with extreme-pressure lubricants under heavy load conditions. Immediate commencement of the investigation of wear is recommended.

[2] See S.A.E. JOURNAL, December, 1932, p. 492, for formula (1).

What Members Are Doing

A. E. Becker

A. E. Becker, Standard Oil Development Co., New York City, and vice-president of the Society representing fuels and lubricants engineering, was scheduled to address a lubrication engineering meeting of the A.S.M.E. at State College, May 25-26. Dr. Becker's subject, "Lubricant Viscosity Standardization for Industrial Equipment," was presented at the machine design session.

Oscar A. Eskuche, for many years associated with Nash Motors and Warren-Nash Motor Corp., New York City, recently resigned as general service manager. He has joined Prof. S. De Vries, formerly of Columbia University, in manufacturing and distributing Valcum products, including liquid cleaning and wax polish.

Benedict Welte, formerly designer, Snyder Tool & Engineering Co., Detroit, is tool designer, Colonial Broach Co., Detroit.

B. L. Affleck, formerly executive engineer, Maccar Truck Co., Scranton, Pa., is now service manager, P. J. Durham Co., Inc., manufacturer's representatives, electrical accessories, New York City.

Ernest G. Bruce is aeronautical engineer, General Aviation Mfg. Corp., Dundalk, Md. Mr. Bruce, a Junior member of the Society, formerly was a graduate student, California Institute of Technology, Pasadena, Calif.

W. Roper Lindsay is employed in the service department of the Ford Motor Co. Ltd., Dagenham, England.

William Landefeld, formerly tool engineer, Buick Motor Car Co., Flint, Mich., is located at 5-154 General Motors Bldg., Detroit.

Arthur R. Decker, chief motor inspector, The Texas Co., has been transferred from Norfolk, Va. to Chicago.

L. M. Mynard has been appointed service manager, Delco-Remy & Hyatt, Ltd. He previously was technical engineer for the company which is located in London, England.

Harry B. Smith formerly service manager and instructor, Pittsburgh Auto Equipment Co., Pittsburgh, Pa., is manager, Butler branch, Dyke Motor Supply Co., Butler, Pa.

Nils G. Bjorck is truck designer, Continental Motors Corp., Detroit. Previously he was chief engineer, National Trucks Associated. Chicago.

Carl S. Schmidt, managing director, Aktiebolaget Pentaverken, Skovde, Sweden, is now located with the company at Gothenburg.

Roy S. Sanford is assistant to the president, Dunbar-Gibson, Inc., New York City. The company is interested in the development of diversified products. Previously, Mr. Sanford was development engineer, Bendix Aviation Corp., South Bend, Ind.

Adam K. Stricker, Jr., sales engineer, Cadillac Motor Car Co., New York City, is specializing on technical features of the 16-cylinder Cadillac.

W. D. Waite, formerly manager manufacturers sales, Dominion Rubber Co., Ltd., Kitchener, Ontario, Can., is now tire sales manager, western division, Winnipeg, Manitoba, Can.

Frederick Knack is checker, General Aviation Mfg. Corp., Dundalk, Md. He began his work with the corporation March 1, 1933.

Charles Healy Day, formerly vice-president, New Standard Aircraft Corp., Paterson, N. J., has become president of Airplanes, Inc. The company is devoted to aircraft sales and operation.

Clyde C. Mathis

Clyde C. Mathis has resigned his position as district service manager, White Co., Pittsburgh, Pa., and joined General Motors Truck Co., Philadelphia, as zone parts and service manager.

A. E. Friedgen, president A. E. Friedgen, Inc., transportation consulting engineers, is now located at 155 East 42nd St., New York City.

James R. Fitzpatrick is vice-president, Haskelite Mfg. Corp., 208 West Washington St., Chicago.

Charles Ezbar Scott is sales engineer for the Haskelite corporation.

Charles B. Norris, mechanical engineer, is in charge of technical work at the Grand Rapids plant of the Haskelite Mfg. Corp.

Donald A. Smith, a new member of the Society, has joined the technical staff of F. H. Levey, Inc., New York City.

Arvid C. Olson has been re-employed as assistant service manager by The Johnson Motor Co., Waukegan, Ill., manufacturers of outboard motors.

D. A. Ross is engineer with the McQuay Norris Mfg. Co. of Canada Ltd., Toronto.

Oswald Bryant, formerly repairs manager, Skurray's Ltd., Swindon, Wilts, England, is works manager Wray Parks Garages, Reigate, Surrey.

Howard E. Coffin, chairman of the board, Sea Island Co., Sea Island, Ga., has recently become chairman of the board, Southeastern Cottons, Inc., New York City.

B. W. Weatherbee, a new member of the Society, is engaged as consultant on liquid rubber problems for a mid-west concern. Until recently he was chemical engineer with the Russell Mfg. Co., Middletown, Conn. Articles by Mr. Weatherbee dealing with important products made from asbestos and rubber, and methods of manufacture appeared in the Feb. 4 and April 22 issues of India Rubber Journal (London).

Victor R. Ellison is temporarily engaged in the engineering department of the B/J Aircraft Corp., Dundalk, Md. Previously he was employed by Great Lakes Aircraft Corp., Cleveland, in power plant installation design.

Fred L. Rockelman has resigned as vice-president in charge of sales, Continental Auto Co. division of Continental Motors Corp., Detroit.

Taliaferro Milton, branch manager, The Electric Storage Battery Co., is now located at 4613 S. Western Ave. Blvd., Chicago.

Ben Levene has given up his position as manager service department, Van Blerck Motor Service Co., Philadelphia, and is now associated with The Bucher and Gibbs Plow Co., Canton, Ohio.

Adolph Schneider is consulting engineer, Beloit, Wis., having resigned his position with the Northern Pump Co., Minneapolis.

Louis Ruthenburg, formerly president and general manager, Copeland Products, Inc., Mount Clemens, Mich., is consultant, refrigeration division, National Electrical Manufacturers Association. He is located in Detroit.

O. E. Day

O. E. Day has given up his position as chief chemist Root Refining Co., Eldorado, Ark., and is now sales service supervisor, Bloomington district, Cities Service Oil Co., Chicago.

W. A. Maynard, formerly regional sales manager, White Co., Chicago, has joined The Lincoln Storage Company as manager of branch warehouse, Cleveland.

Francis M. Johnson is with the Cason Six Wheel Attachment Co., New Haven, Conn.

Moritz Nielson is experimental engineer, merchandise research, Montgomery Ward & Co., Chicago.

William M. Horton is general superintendent, Russel, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y. Previously to his joining this company about six months ago, Mr. Horton was assistant general plant manager, Lamson-Sessions Co., Cleveland.

Howe H. Hopkins is resident engineer, Boston district, National Carbon Co. Mr. Hopkins is a Prestone specialist. Previously he was representative Dayton Rogers Mfg. Co., Minneapolis.

Adam M. Steever is now associated with The Lindberg Steel Treating Co. as vice-president in charge of technical operations, having resigned his position as metallurgical engineer, Great Lakes Forge Co., Chicago. Previously he was connected with Buick and Chevrolet Motor Divisions of the General Motors Corp., Flint, Mich., and the Ingalls Shepard Division of the Wyman Gordon Co., Harvey, Ill.

Sir Frederick Henry Royce

Sir Frederick Henry Royce, an affiliate member representative of the Society, died at his home in Sussex, England, April 22, at the age of 70.

At the time of his death Sir Henry was chief engineering director, Rolls-Royce of America, Inc., Springfield, Mass. He began his automotive career when after buying an automobile for use in his electrical business, its many shortcomings induced him to build a car of his own. He received financial assistance from the Hon. C. S. Rolls, one of Great Britain's early automobile enthusiasts, which led to the organization of Rolls-Royce, Ltd. The noted British engineer's first car was a 2-cylinder of 10 hp.

After Rolls' death, which occurred in an airplane accident in 1910, Royce continued as the engineering head of the business and was responsible not only for the development of the Rolls-Royce car but also for a series of aircraft engines during the war. Later his engines enabled England to win world's speed championships on land, water and in the air. He was granted the title of baronet in 1930 after a Rolls-Royce engine had empowered the winning plane in the Schneider Cup Races.

John Paul Thompson

John Paul Thompson, recently welcomed into Junior membership in the Society, died suddenly April 22.

At the time of his death, Mr. Thompson was junior aeronautical engineer, Naval Aircraft Factory, Philadelphia. Previously he had been employed by Ford Motor Co., Detroit, and Goodrich Tire Co., Akron. He received B.S. degree in aeronautical engineering at M. I. T. in 1930 and A.B. degree in physics, Oberlin College in 1927.

Harold Welch Fairchild

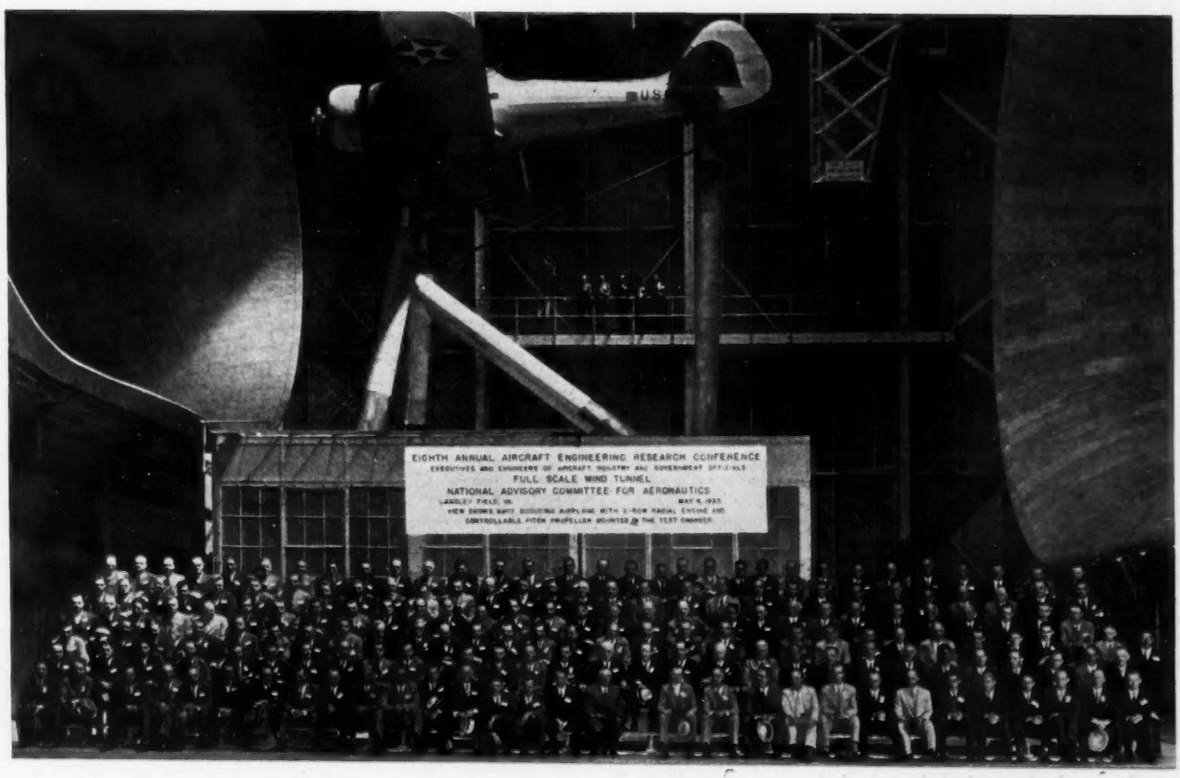
Harold Welch Fairchild, a junior member of the Society, was killed in an airplane accident on April 10. At the time of his death he was engineering test pilot in the research division of the United Aircraft & Transport Corp. at Hartford, Conn.

Mr. Fairchild was born in Pelham, N. Y., on April 29, 1908. He was graduated in aeronautical engineering from M. I. T. in 1929, after which he completed a year's flight training course with the Air Corps at Brooks and Kelly fields. He became associated with the United company in 1930 and had an important part in the development of improved flight test methods. With F. M. Thomas he wrote a paper on "Airplane Flight Testing for Maximum Speed" which he read at the annual meeting of the Society in Detroit last January. The paper subsequently was published in the Transactions section of the March issue of the S.A.E. JOURNAL.

Mr. Fairchild was a first lieutenant in the 118th Observation Squadron, 43rd Division Aviation of the Connecticut National Guard at Hartford.

In commenting upon Mr. Fairchild's sudden death, Charles H. Chatfield, assistant director of research, The United Aircraft & Transport Corp., said, "In his death the aeronautical engineering profession loses one of the best of its younger members."

Society Members Prominent at Aircraft Engineering Research Conference



Some 200 leaders in aeronautical engineering gathered at the Langley Memorial Laboratory at Langley Field, Va., early in May to witness demonstrations of advances made in aircraft safety and efficiency.

Dr. G. W. Lewis, member of the S.A.E. Council and director of aeronautical research, National Advisory Committee for Aeronautics, and Dr. Joseph S. Ames, chairman of the committee, were in charge of the demonstrations.

The illustration shows the conferees gathered under a Navy scouting plane, with 2-row radial engine and controllable pitch propeller, mounted in the test chamber.

News of the Sections

Traffic Safety Activity Proposed at Metropolitan Section Meeting

A NEW Society activity providing for S.A.E. cooperation with law enforcing bodies to assure a definite understanding by the legislative end of the industry in relation to the engineering or technical side, was proposed in a resolution to the Council and adopted by the Metropolitan Section at its meeting held May 18, New York City.

The new activity as proposed in the resolution would be known as the Traffic Safety and Administration Activity. The necessity for this cooperative effort was emphasized by John F. Creamer, president, Wheels, Inc., New York City. Joseph A. Anglada, president, Anglada Motor Corp., New York City, read the resolution, which was adopted unanimously by the Section.

It was forcefully pointed out, at this joint meeting of the aeronautic and marine divisions, that the principles of aeronautic engineering as applied to the designing of streamlined bodies do not necessarily apply to the marine field. This point, which has been hazy in the minds of automotive engineers for some time, was definitely clarified in the reading of two papers, one pertaining to aeronautic engineering and the other to naval architecture. A body moving through air obeys certain laws and the same laws which would seem to apply to the fluid water actually do not, because the water beneath a motorboat is a mixture of air and water and therefore the characteristics of bodies moving through this matter do not follow altogether the laws of air or water as such.

Gee Bee Ships Discussed

Z. D. Granville, president, Granville Brothers Aircraft, Inc., constructors of the 1932 Gee Bee Super Sportster which won the Thompson Trophy at the National Air Races when piloted by Major Jimmy Doolittle, presented a most interesting paper. The chief reason for the development of the ship was the desire to use a radial engine. This resulted in the barrel-like fuselage so characteristic of the Gee Bee ships. Although upon first observation it would seem that the Gee Bee ships are extremely short, this is not the case when they are compared with the ordinary airplanes of today. The barrel-like fuselage of the Gee Bee gives the appearance of stubbiness. Mr. Granville explained the many details adopted, stating that the success of the ship was due to close attention to detail; particularly such details as the comfort of the pilot, and the design of control surfaces which would not give undue sensitive control at high speeds and which would still be safe to control the ship at stalling speeds.

W. S. Peper, Stewart-Davis Advertising Agency, New York City, presided at the aeronautic session, and W. E. John, Metropolitan Section, vice-chairman of marine activity, then introduced T. F. Meyer, manager, propeller division, Federal-Mogul Corp., Detroit, who read a paper on the design of the propellers for Miss America X, the holder of the world's motorboat speed record and also winner of the Harmsworth Trophy. Mr. Meyer discussed the design of the types of propellers which have been used up until now and showed how the stresses on the ordinary type of propeller running at nearly 8000 r.p.m., as required on the Miss America X, would not have been able to withstand the centrifugal and thrust forces exerted by a wheel turning over at this high speed.

Test Equi-Poise Wheel

Details of the evolution of the Equi-Poise blade wheel, which was finally adopted as the propulsive unit for Miss America X were discussed by Mr. John. He pointed out the inability of trial runs because of the necessity for avoiding any risks with the boat before the races and stated that the first wheels completed were entirely successful and, other than the polishing and hand-scraping of the surface of the blades, they performed perfectly in the races. He also discussed the possibility of applying the Equi-Poise propeller to standard runabouts and cruisers and said that a new value of performance would be injected into the motorboat picture; namely, acceleration. Although one does not ordinarily think of acceleration of a motorboat, the test with the new Equi-Poise wheel indicated that both a cruiser or a runabout gets under way much quicker with the new type of wheel as compared to the standard wheels heretofore used.

The discussers of the aviation papers were Prof. Alexander Klemin and Arthur Nutt. George F. Crouch discussed Mr. Meyer's paper. There was a consensus of opinion that the combined aviation and marine meeting is very desirable, because of the many similar problems that apply to both fields.

New Officers

The following officers were elected for the 1933-34 season: W. S. Peper, chairman; W. E. John, vice-chairman; Clarence Chamberlin, vice-chairman for aeronautics; W. H. Farnsworth, vice-chairman for marine; C. F. Scott, treasurer; C. H. Baxley, secretary.

Through the courtesy of Gar Wood, Wood Hydraulic Hoist & Body Co., Detroit, four reels of sound films showing Miss America X in trials, winning the Harmsworth Trophy and establishing the world's speed records, were shown. About 75 attended dinner and 265 were present at the meeting.

Hauling and Dumping Equipment Discussed

Specialized Field Studied At Milwaukee May Meeting

A complete study of earth moving equipment and other machinery involving extremely interesting examples of specialized automotive engineering was made by members of the Milwaukee Section at the May 10 meeting held at the plant of the Koehring Co.

Previous to the regular meeting, 88 members and guests inspected the Koehring shops where they witnessed demonstrations of shovel, crawler and wheel "dumptor" machines. Movie action exhibits depicted dumptor equipment in use in Florida swamps, Texas heat, Iowa mud, Michigan sands and Minnesota snow. An inspection also was made of a paver machine in action.

The development of front dump and spread earth hauling equipment was discussed at the meeting by R. T. Osman, Koehring Co. Beginning with a 1½ yd. wooden box on a Fordson tractor, he traced the evolution of this equipment, describing the 4-wheeler, semi-crawler, dual-engines and full-crawler types which preceded the single motor pneumatic tire, 4 yd. machine of today.

Pointing out the occasional monetary reward in basic patents, Eric H. Lichtenberg, Koehring Co., explained how an Illinois road contractor is collecting attractive royalties from the idea of two standard paver mixers in tandem.

Vice-Chairman Paul W. Eells, assistant to president, LeRoi Co., West Allis, presided at the meeting in place of Chairman P. C. Ritchie, Waukesha Motor Co., who was detained in Chicago. A cordial welcome was extended to the members and their guests by W. J. Koehring, on behalf of the Koehring Co.

The annual election of officers resulted as follows: Chairman, Paul W. Eells; vice-chairman, C. E. Frudden; treasurer, C. M. Eason, secretary-treasurer, Fawick Mfg. Co., Waukesha; secretary, George C. Appel, engineering department, Globe Union Mfg. Co.

Dickinson at Philadelphia

Dr. H. C. Dickinson presented his now famous "Mechanics of Recovery" talk before nearly 100 members and guests at the Philadelphia Section meeting on May 10. General manager John A. C. Warner told of recent progress made by the Society and presented to the Section and its members prizes won in the "Get-Your-Man" membership campaign.

John Hardecker was present to receive in person the life membership which was awarded to him as winner of the individual contest for the whole country and the radio which came to him as high man for the Philadelphia Section.

Autogiro Development Interests Northwest

Attain Speed of 130 M.P.H.—Experiment on Metal Blades

Declaring that the autogiro is now past the experimental stage as far as proving flight ability is concerned, R. W. Morse, Boeing Airplane Co., Seattle, Wash., pointed out the present advantages of this type of airplane in forestry work and other mountainous use, as well as ship-to-shore service.

Speaking at the May 12 meeting of the Northwest Section at Seattle, Mr. Morse expressed the hope of further development of the autogiro which would make it a commercial competitor of the fixed-wing type of airplane.

In calling attention to the recent development in France of a wingless type autogiro, Mr. Morse said that experiments are now under way to make the autogiro's blades of stainless steel or some other metal. Top speeds upward of 130 m.p.h. have been attained by the autogiro.

Mr. Morse's talk followed a showing of a film by the courtesy of United Airlines depicting a trip by one of the company's planes from the Golden Gate to the Statue of Liberty in 27 hr. The picture also showed the method of servicing the ships and training of personnel.

In describing the mechanical rotor-starter by which taxiing is eliminated, Mr. Morse explained that the starter is simply a gear-driven drive through a manually-controlled clutch and an overrunning clutch to a pinion and ring gear on the rotor hub. By means of the starter, he said, the rotor has been brought up to 120 r.p.m. in 20 sec. in an autogiro flown by King Baird at Boeing Field recently.

The tendency of the autogiro to smooth out the rough spots in bumpy air is one feature of this type ship that is frequently misunderstood, declared Mr. Morse. He explained this action as being due to the heavy wing loading of the autogiro blades (between 30 and 60 lb. per sq. ft.), and the fact that the blades are permitted to flap, which, he said, makes an effective shock-absorbing medium.

The meeting brought to a close a successful series held during the current administrative year under the chairmanship of Charles C. Finn, Northwest manager, John Finn Metal Works. Officers elected for the coming year are: chairman, Sherman W. Bushnell, chief engineer, Hedges Motor Co.; vice-chairman, John G. Holstrom, chief engineer, Kenworth Motor Truck Corp.; secretary, James H. Frink, assistant manager, Washington Iron Works; treasurer, Reese Lloyd, superintendent, Sunset Electric Co.

Buffalo Views Air Photos

An enthusiastic meeting of the Buffalo Section was featured by a talk on aerial photography by Capt. Albert W. Stevens, Air Corps, U. S. A., and the presentation of the famous Becker film on "Front Wheel Tramp and Shimmy Phenomena" by Dr. H. C. Dickinson, president of the Society. Presided over by general manager John A. C. Warner, the meeting brought to a successful close the current administrative year under the chairmanship of M. A. Thorne. It was held at the Hotel Statler, May 16, and was attended by 135 members and guests. Mr. Warner presented "Get-Your-Man" prizes won by Buffalo Section members.

Captain Stevens, probably the world's foremost authority on aerial photography, illustrated an exceptionally interesting talk on his work in this branch of the service by colored lantern slide projections.

He told of his experiences when in 1924 he flew 12,000 miles over the Amazon jungles and mapped the uncharted Parima River. Following this work, Captain Stevens photographed the highest peaks of the Andes Mountains. He also was chief photographer of the National Geographic Society's expedition to photograph the solar eclipses of 1923 and 1932.

Captain Stevens exhibited a photograph—said to establish a world's record for territory covered in a single picture—showing a view of Mount Shasta taken from an airplane over Salinas, Cal., a distance of 373 miles.

The following officers were elected for 1933-34: Chairman, Fred A. Cornell, manager, Electro Devices Co.; vice-chairman, Karl M. Wise, director of engineering, Pierce-Arrow Motor Car Co.; secretary-treasurer, Carl F. Lautz, chief engineering, Houde Engineering Corp.

Study Road Tests of Fuels at So. California

Road testing of motor fuels by modern methods was discussed by Lawrence J. Grunder, automotive engineer, Richfield Oil Co., at the May 19 meeting of the Southern California Section, Los Angeles.

Following the presentation of Mr. Grunder's paper a lively discussion was participated in by Chairman Charles F. Lienesch, manager aviation, Union Oil Co. of California; Ethelbert Favary, consulting automotive engineer; Charles H. Paxton, University of California; J. F. Dickson, J. F. Dickson Co.; Claude E. Botkin, W. F. Hamilton, and F. W. Thomas.

The following officers were elected for 1933-34: Chairman, Charles H. Jacobsen, service manager, Moreland Motor Truck Co.; vice-chairman, Ernest E. Tattersfield, president and general manager, Electric & Carburetor Engineering Co.; vice-chairman for aeronautics, William B. Birren, western representative, Wright Aeronautical Corp.; treasurer, J. Jerome Canavan, Canavan-Kunkel Co.; secretary, W. E. Powelson, master mechanic, Fire Dept., Los Angeles County.

More than 100 members and guests were present at the meeting and 73 attended a dinner in the Richfield Building Cafeteria, which preceded the meeting.

Safety Glass at Dayton

The manufacture of safety glass and its application to automobile practice was studied by the Dayton Section meeting held at the Engineers Club, April 20.

In talking on the subject R. A. Miller, technical sales engineer, Pittsburgh Plate Glass Co., also discussed the manufacture of laminated plate glass and plain glass. In giving the members the benefit of his many years of research experiences in the development of safety glass, Mr. Miller supplemented his talk with an interesting motion picture showing the various processes involved in glass manufacturing.

F. L. Prescott, chairman of the Section, presided at the meeting and conducted the instructive discussion which followed Mr. Miller's address.

Statistics at Syracuse

The foolishness of statistics was the subject given serious consideration by members of the Syracuse Section at the May 8 meeting held at the Onondaga Hotel.

Dr. Burges Johnson, director of public relations, Syracuse University, was the principal speaker at the meeting which was preceded by a dinner at which more than 160 members and guests were present.

Urges Joint Treatment Of Engines and Fuels

Their Interdependence Stressed at Baltimore

The intimate relation between engine design and fuel qualities, such as detonation and volatility, was stressed by Neil MacCoull in an address at the April 20 meeting of the Baltimore Section.

Mr. MacCoull, who is director of mechanical research, The Texas Co., showed the theoretical and practical advantages of high compression engines to be primarily reduced weight per horsepower with a resulting increase in acceleration and hill climbing ability. He pointed out that due to the premium paid for high antiknock fuels, there exist economic limitations to increases in compression ratios; practical limitations to very high compression ratios result from high engine stresses which would necessitate redesign for greater strength.

Mr. MacCoull briefly mentioned theories regarding detonation, especially to the effect of the length of flame travel, for the purpose of indicating the influence of engine design on detonation tendencies. Optical studies of flame movement across a cylinder head by Witherow and Boyd were quoted.

In Mr. MacCoull's opinion, correlation between antiknock values of engine fuels and their spontaneous ignition temperatures have not in the past been successful, probably because data in regard to the ignition temperatures were not taken under conditions similar to those existing in engine cylinders. In determining the ignition temperature of a fuel in an engine, Mr. MacCoull believes it is necessary to have due regard for the time allowed to elapse after ignition before the combustion occurs, as well as the mixture ratio, pressure and the proportion of neutral gases present. Ignition temperatures for fuels, as obtained from the compression ratio required for ignition in a Diesel engine, showed quite satisfactory agreement with the antiknock values obtained in the conventional gasoline engine, according to Mr. MacCoull.

In Mr. MacCoull's opinion, the design of engines and the physical properties of the fuels used in them must develop hand in hand if the best performance is to be obtained from an engine; a fuel must be given antiknock and volatility properties suitable for the engine in which it is used and engines must be designed with the proper intake heating and compression ratio for the fuel that is to be used.

Cleveland Visits Akron

Three interesting and instructive talks were presented by Dean Fred Ayres, College of Engineering, University of Akron; Frank Jardine, chief engineer, castings division, Aluminum Co. of America, Cleveland, and M. A. Taylor, B. F. Goodrich Rubber Co., at the May meeting of the Cleveland Section held at Akron.

Dean Ayres' interesting talk was on "Depression Blessings." Mr. Jardine in speaking on "Aluminum in the Automobile Industry," stressed the importance of Lo-ex alloy in this work. Mr. Taylor's paper described experiments conducted while developing a new method of de-icing airplane wings.

About 100 attended a dinner which preceded the meeting. T. A. Aspwell, general manager, tire sales, auto division, B. F. Goodrich Rubber Co., served as toastmaster.

The following officers were elected for 1933-34: Chairman, W. S. Howard, chief inspector, salvage supervisor, White Motor Co.; vice-chairman, H. E. Simi, chief engineer, Twin Coach Co., Kent, Ohio; treasurer, T. R. Stenberg, brake engineer, Firestone Tire & Rubber Co.;

secretary, W. G. Piwonka, engineer, Cleveland Railway Co., Cleveland.

The regular meeting was held in conjunction with the annual outing which included inspection trips through the plants of the Goodyear Tire & Rubber Co., the Miller Rubber Co., and spirited golf tournaments at the Portage Country Club. The golf winners included C. T. Klug, sales manager, Willard Storage Battery Co., Cleveland; R. W. Knowles, transportation engineer, White Co., Cleveland; J. B. Shea, Firestone Tire & Rubber Co., Akron.

New Body Structure Is Urged at Detroit

Cageless Roller Bearings and Aerial Mapping Also Discussed

To produce a car that a poor man can operate as cheaply as he buys mileage on a street car—that is the problem facing the automotive industry according to Hal Holtom, sales engineer, New Era Motors Corp., New York City, who spoke to members of the Detroit Section on April 17.

Addressing the body activity session, held simultaneously with meetings of the passenger car and aeronautic activities, on "Automotive Millstones from the Structural and Economic Viewpoint," Mr. Holtom criticized the industry for having made no substantial reduction of vehicle weight in relation to pay load, a problem in which, in his opinion, the all-steel body makers can play an important part.

"From the manufacturer's standpoint," said Mr. Holtom, "each year finds us giving the user more iron per vehicle and getting less for it per pound. From the standpoint of overall economy, both to the manufacturer and car user, considerable of the costly fabricated weight of today's automobile benefits nobody and constitutes an economic millstone to all concerned from the assembly lines to the junk yard."

At the aeronautic activity session, Capt. Bruce Hill, engineering corps, U. S. Army, Wright Field, Dayton, Ohio, described Army mapping methods. It is his belief that the cost of mapping by airplane is between 5 and 20 per cent of the cost of ground methods.

Cageless roller bearings were discussed in a comprehensive paper presented at the passenger car activity session by Karl L. Herrmann, engineer Bantam Ball Bearing Co., South Bend, Ind. Mr. Herrmann described tests which give support to the report that the bearing will stand more load than the shaft. Data was presented on the application of cageless roller bearings. Mr. Herrmann pointed out that any lubrication means applicable to anti-friction bearings of other types or plain bearings is more than ample, according to all available information.

In discussion of Mr. Herrmann's paper it was said that small cageless roller bearings have been operated successfully in commercial use as high as 5000 r.p.m., and that on Diesel engine work installations have been made on wrist pin carrying loads as high as 7000 lb. per sq. in. of projected area.

After pointing out that this Country should evolve a style of its own that would lend itself structurally to methods we are naturally fitted for, Mr. Holtom presented to the members attending the body activity session, recommendations for designs of all steel integral structures that would, in his opinion, attain this end. He also made recommendations for research to evolve still lighter designs in the future.

Mr. Holtom also suggested recommendations for designs of all steel structures (jig built) for commercial vehicles—a worthwhile outlet, he said, for the products of the all-steel body maker. He suggested that such bodies could be constructed in quantities standardized as to size and shape but with variables as to inner compartments. Mr. Holtom declared that the manner in which steel body makers have tackled the problem of manufacturing ice boxes if applied to the commercial vehicle field would offer a solution to many problems in the truck business.

An all-steel body and chassis construction as one unit, according to Mr. Holtom, would make possible a car that, compared to the conventional type, would be stronger, lighter, cheaper to operate, less expensive to build, better streamlined, faster and more practical. In such a car as described by Mr. Holtom, a light pneumatic rail would run completely around the outside of the streamline structure, which he pointed out, would be more useful than the present bumpers. There would be sufficient room inside this new car to carry spare wheels, tires, trunk rack and other equipment which decorates the present car. Even fenders and running boards would disappear, as wheel housings would take their place. Probably rubber or fluid would be adapted in place of steel for suspension purposes, Mr. Holtom suggested, and shock absorbers and such gadgets would be eliminated and individual wheel suspension would reduce weave on body structure to a minimum.

One wide sliding or folding door would suffice in the new car, just as it does in the modern airplane which Mr. Holtom pointed out carries probably 4 times as many persons as the ordinary passenger car. Passengers in the car described by Mr. Holtom would sit on cushions of air and rubber rather than on steel-spring seats as in present cars. Rubber and air, Mr. Holtom said, are less expensive and lighter than steel.

In advancing these and other recommendations, Mr. Holtom pointed out that with the possible exception of the suggested steering and suspension media (fluid and rubber in place of steel), they could not be termed radical or revolutionary. His intention in making such proposals, he said, is to speed-up in an era that demands it, the natural evolution of stamping practices in a product that lends itself to stampings more than anything else. Mr. Holtom said his purpose is to obtain in a functional sense a stronger overall vehicle and a far lighter and simpler structure, as a whole, than is used at present. He emphasized the importance of the shape of the structure as a dominating factor towards attaining this end, and declared that to do this, man simply had to copy the streamline structures of nature.

More than a hundred were in attendance at each of the three separate sessions and there was lively discussion at each. John W. Votypka, chief engineer, LeBaron-Detroit Co., Detroit, presided at the meeting of the body activity group. Ralph N. DuBois, chief experimental engineer, Continental Aircraft Engine Co.. Detroit, and George B. Allen, chief engineer, passenger car division, Dodge Bros., Detroit, were in charge of the meetings of the aeronautic and passenger car activities, respectively.

Canadians Hear Dickinson

Dr. H. C. Dickinson was the chief speaker at the Canadian Section meeting on May 17 which was attended by 125 members and guests. His topic was "The Mechanics of Recovery" and the discussion generated by his talk lasted until nearly midnight. General manager John A. C. Warner acted as chairman and presented prizes won by Canadian Section members in the "Get-Your-Man" membership campaign.

Meetings Calendar

Metropolitan—June 16 to 18, Spring Lake Meeting

Shoreham Hotel, Spring Lake, N. J.

Research Aids Aluminum Tank and Truck Bodies

Construction Improvements Noted by Pittsburgh Group

Building truck and tank bodies of strong aluminum alloys is a comparatively recent development, but at the meeting of the Pittsburgh Section in the Fort Pitt Hotel on May 18, M. M. Dean, truck development engineer of the Aluminum Co. of America, showed that engineering research on these truck bodies had already reached a high point of development. A. R. Ferguson, also of the development division of the Aluminum Co., explained the use of aluminum alloys in tank body construction and explained how the strength of the various parts was calculated mathematically by a somewhat similar formula as has been used for calculating stresses in large pipe-lines.

The annual frolic dinner was attended by 47 members and guests, while later arrivals increased the attendance to 65. Chairman Charles R. Noll, Gulf Refining Co., presided. Attendance prizes were given to eight members who had attended every meeting during the past year.

John M. Orr, Equitable Auto Co., reported the election of the following officers for the 1933-1934 season: Chairman, Murray Fahnestock, Ford Dealer & Service Field; vice-chairman, A. R. Platt, A. R. Platt Co.; secretary, Fred W. Heisley, Jos. Woodwell Co.; treasurer, Robert Austen, Iron City Spring Co..

The "extrusion" process of fabricating unusual shapes, such as roof cornices, makes it possible, Mr. Dean said, to combine in a single piece of aluminum, members and functions which would ordinarily require several members and added weight, if made of rolled sections, as is necessary with steel.

Body builders present showed much interest in this extrusion process, in which the heat-softened alloy is forcibly squeezed through an orifice, and in learning that these extruded sections were available in sufficient lengths to meet all truck and trailer building requirements.

The physical properties of the aluminum alloys fabricated by the extrusion process were said to be about the same as those for rolled aluminum, and Mr. Dean pointed out that both were worked or wrought metal.

Mr. Ferguson discussed the manner in which the various kinds of tank bodies, including round, oval and elliptical could be economically fabricated of aluminum alloys with weight reductions that often made it possible to carry a considerable increase in pay load, without exceeding the gross load restrictions imposed by many states.

An animated discussion participated in by William G. Mayer, Mayer Body Co., Fred. W. Heisley, Jos. Woodwell Co., H. E. Benson, Gulf Refining Co., B. H. Eaton, Bell Telephone Co., and A. R. Platt brought out that the special field for the use of aluminum alloys in truck and trailer body construction now lies in making it possible to increase the pay load while still using the same chassis and power plant. Or to carry a heavier pay load, without exceeding the gross loads allowed in certain states.

A letter of discussion from J. F. Winchester,, Standard Oil Co. of N. J., conveyed the appreciation of members of the American Petroleum Institute for research and test work done on tank body construction.

Notes and Reviews

THESE items, which are prepared by the Research Department, give brief descriptions of technical books and articles on automotive subjects. As a rule no attempt is made to give an exhaustive review, the purpose being to indicate what of special interest to the automotive industry has been published.

The letters and numbers in brackets following the titles classify the articles into the following divisions and subdivisions: *Divisions*—A, Aircraft; B, Body; C, Chassis Parts; D, Education; E, Engines; F, Highways; G, Material; H, Miscellaneous; I, Motorboat; J, Motorcoach; K, Motor-Truck; L, Passenger Car; M, Tractor. *Subdivisions*—1, Design and Research; 2, Maintenance and Service; 3, Miscellaneous; 4, Operation; 5, Production; 6, Sales.

AIRCRAFT

Calculation of the Motion of an Airship Under Certain Conditions

By D. H. Williams and A. R. Collar. Published in *The Journal of the Royal Aeronautical Society*, January, 1933, p. 35. [A-1]

The work described deals, in detail, with the methods whereby the motion of an airship can be calculated. The possible motions of an airship are affected by such factors as stability, motion of controls, release of hydrogen, dropping of ballast, engine power available, and gustiness of the air. The methods outlined are capable of dealing with these effects either separately or combined in any arbitrary proportions.

The opportunity for beginning the investigation came as a result of a request from the Court of Inquiry into the disaster to H. M. Airship R. 101.

Wing Characteristics as Affected by Protuberances of Short Span

By Eastman N. Jacobs and Albert Sherman. N.A.C.A. Report No. 449, 1933; 10 pp., 9 figs. Price, 5 cents. [A-1]

Wind-Tunnel Research Comparing Lateral Control Devices, Particularly at High Angles of Attack. X. Various Control Devices on a Wing With a Fixed Auxiliary Airfoil.

By Fred E. Weick and Richard W. Noyes. N.A.C.A. Technical Note No. 451, March, 1933; 18 pp., 13 tables, 3 figs. [A-1]

The Aerodynamic Effect of a Retractable Landing Gear

By Smith J. DeFrance. N.A.C.A. Technical Note No. 456, March, 1933; 3 pp., 3 figs. [A-1]

The Aerodynamic Characteristics of Airfoils as Affected by Surface Roughness

By Ray W. Hooker. N.A.C.A. Technical Note No. 457, April, 1933; 10 pp., 11 figs. [A-1]

The Effect of a Gap Between Elevator and Stabilizer on the Static Stability and Maneuverability About the Lateral Axis in Flight

By Walter Hübner. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 23, No. 11, June 14, 1932; Verlag von R. Oldenbourg, München und Berlin. N.A.C.A. Technical Memorandum No. 701, March, 1933; 4 pp., 7 figs. [A-1]

Take-Off and Propeller Thrust

By Martin Schrenk. Translated from *Zeitschrift für Flugtechnik und Motorluftschiffahrt*, Vol. 23, No. 21, November 14, 1932; Verlag von R. Oldenbourg München und Berlin. N.A.C.A. Technical Memorandum No. 703, April, 1933; 27 pp., 16 figs. [A-1]

Preliminary Study of Retractable Landing Gears for High and Low Wing Monoplanes

Air Corps Technical Report No. 3718, February 18, 1933; 9 pp., with tables and charts. Published by the Chief of the Air Corps, City of Washington. [A-1]

A Speedometer Which Indicates True Airspeeds

By Tatudiro Sasaki and Tokuro Yosida. Report No. 95 of the Aeronautical Research Institute, Tokyo Imperial University, March 1933; 21 pp., with tables and charts. [A-1]

(Continued on page 38)

Can Give Your Cars

FULL *Brake Protection*

Brakes are in the Spot-Light! The Important Difference—so Dramatically Demonstrated—Between

"FULL POWER" BRAKES and "PARTIAL POWER" BRAKES

Will Sell More Cars for Your Dealers

Stewart-Warner Automatic "Full Power" Brakes are the first instantly responsive brakes to harness the giant power of car momentum for braking and put it completely under driver's control.

The evidence that power—not leg muscle—does all the work of braking is the Stewart-Warner low brake pedal.

No technical explanation is required to prove the advantages of these brakes over partial power brakes, which depend upon leg muscle, assisted by booster devices. The prospect sees the difference—feels the difference in the first demonstration.

The quicker rotation of the foot from accelerator to the low brake pedal is self-proving. That it is easier and quicker to apply the brakes with a gentle, rocking motion of the low brake pedal than with the longer action required with high brake pedals is also self-evident.

—And, in a quick stop, the absence of side sway, due to the uniform distribution of braking force to all four rigid, non-energized wheel brakes is a revelation to the driver. Even on curves he will find that he can stop without loss of steering control—thanks to the automatic release of braking force on the front wheels in proportion to the angle of turning—an exclusive feature of Stewart-Warner Brakes.

After such a demonstration, the prospect knows that these are the quickest, most easily and accurately controllable—the safest brakes he has ever used.

Stewart-Warner Automatic "Full Power" Brakes are designed for factory installation on motor cars, motor coaches and trucks. Investigate them. Our engineers are at your command.

The foot on this low brake pedal

controls the power unit which harnesses the force of car momentum to

do all the work of applying these non-grabbing Stewart-Warner non-energized wheel brakes.

Stewart-Warner Automatic "FULL POWER" Brakes Will Do More To Boost Car Sales Than Any Other Feature

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"FULL POWER" BRAKES

NOTES AND REVIEWS

Continued

ENGINES

The Theory and Practice of Air Cooling—A Correlation of the Problem of Design with Researches on the Boundary Layer

By D. R. Pye. Published in *Aircraft Engineering,* February, 1933, p. 31. [E-1]

The author explains at the outset of this article, which is the first of a series, that this study of the principles of air cooling will not extend to any detailed description of the ways in which those principles have been applied in practice; but rather that he has endeavored so to condition theory by practice as to produce results of real interest to the practical man.

Mr. Pye has attempted to correlate the engineers' problem of designing an adequately cooled cylinder with the theoretical and experimental researches on the boundary layer, and the laminar flow within it, which start with Blasius' development of the Lanchester-Prandtl theory and end with the experimental measurements of the velocity and temperature gradients in an airstream very close to a hot surface.

To make the study more complete he has included also a simple mathematical treatment of the cooling efficiency of fins, from which conclusions of direct practical importance can be drawn.

Light Aero Engine-Airscrew Combinations

By W. R. Andrews. Published in *The Aircraft Engineer,* supplement to *Flight,* Dec. 1, 1932, p. 1152a (81); Dec. 29, 1932, p. 1232d (92) and Jan. 26, 1933, p. 80a (1). [E-1]

Mr. Andrews comments on the causes of the trend away from the light engine for the single-seater airplane toward the more powerful engine and explains the variations which influence the problems of the airscrew.

The paper is divided into three parts: Part I, The effect of increasing design r.p.m. on an engine of constant cylinder capacity fitted to a very clean monoplane; Part II, The effect of varying engine size and r.p.m. at constant b.h.p. (fitted to the above monoplane); Part III, The effect of increased drag.

Photomicrographic Studies of Fuel Sprays

By Dana W. Lee and Robert C. Spencer. N.A.C.A. Report No. 454, 1933; 27 pp., illustrated. Price, 10 cents. [E-1]

The Importance of Auto-Ignition Lag in Knocking

By E. S. Taylor. N.A.C.A. Technical Note No. 452, March, 1933; 7 pp., 2 figs. [E-1]

The N.A.C.A. Combustion Chamber Gas-Sampling Valve and Some Preliminary Test Results

By J. A. Spanogle and E. C. Buckley. N.A.C.A. Technical Note No. 454, March, 1933; 11 pp., 6 figs. [E-1]

Increasing the Volumetric Efficiency of Diesel Engines by Intake Pipes

By Hans List. Translated from *Mitteilungen aus den Technischen Instituten der Staatlichen Tung-Chi Universitat,* Report No. 4, April, 1932. N.A.C.A. Technical Memorandum No. 700, March, 1933; 26 pp., 32 figs. [E-1]

Investigating Mixture Distribution—The Combustion Temperature Method for Routine Testing

By Hector Rabezzana and Stephen Kalmar. Published in *The Automobile Engineer,* December, 1932, p. 587. [E-1]

Balancing the output of the engine, or the provision of perfectly even torque, has become one of the designer's most important problems, the authors contend, adding that regarding the fundamentals of the induction system design, a need exists for a method that can be employed as a routine test for measuring mixture distribution, not only as an effect or indication, but actually for determining the relative leanness or richness of cylinder mixtures under any of the actual operating conditions.

The various methods in use are enumerated together with their advantages and disadvantages and the combustion temperature method described in detail accompanied by voluminous test results.

Druckanstieg, Gasschwingungen und Verbrennungsgeräusche bei der Verpuffung von Kraftstoffen

By Prof. Wawrziniok. Published in *Automobiltechnische Zeitschrift,* Feb. 10, p. 73 and March 10, 1933, p. 136. [E-1]

An elaborate set of laboratory equipment was used by the automotive laboratory of the engineering college at Dresden in its recent investigation of detonation. It consisted of a bomb in which was set a piezoquarz

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NOTES AND REVIEWS

Continued

indicator and other apparatus which provided simultaneous, inertia-free electrical recording of pressure increase, the time of ignition, combustion noise and flame front travel.

Tests with hexane vapor and gasoline vapor-air mixtures are said to have demonstrated the practicability and dependability of the apparatus. Among the findings were that combustion noise was set up before the flame had reached the bottom of the bomb and that such noise was a secondary manifestation of longitudinal vibrations in the gas. Tests with a single-cylinder engine are said to have confirmed the result of the bomb study.

MATERIAL

Some Molybdenum High Speed Steels

By J. V. Emmons. Paper presented at the Fourteenth Annual Convention of the American Society for Steel Treating, Buffalo, N. Y., Oct. 3 to 7, 1932. [G-1]

The author reports an investigation made of the properties and performance of several types of molybdenum high speed steels. The mechanical properties of hardness, strength and plasticity were determined for each type of steel through an extensive range of heat treatments.

The microstructures were studied and interesting observations are discussed in the paper.

The cutting quality was determined by means of an extensive series of drilling tests. Brief correlations are made between the cutting quality, the structure and the mechanical properties.

Comparisons are made between the molybdenum steels and some well known types of tungsten high speed steels.

The paper also describes a new type of molybdenum high speed steel, carrying about one-fourth as much tungsten as molybdenum, which was developed and found to be superior in many respects to the molybdenum high speed steels previously examined.

Alloy Cast Irons in Automobile Construction

By A. B. Everest. Published in *The I. A. E. Journal*, January, 1933, p. 57. [G-1]

Interest in alloy cast irons was first aroused about five or seven years ago, when changes in engine design and more exacting service demands brought such problems as cylinder wear into prominence. The use of alloy additions in the irons is one of the methods which has received extensive attention and in many cases been adopted to meet the rigorous demands. In this paper, the author reviews the progress made during these years and examines the present position in this special branch of metallurgical engineering.

Metallurgical Problems Arising From Internal Combustion Engine Valves

By J. R. Handforth. Published in *Engineering*, Jan. 13, 1933, p. 55; Jan. 20, 1932, p. 83. [G-1]

Experience has shown that the requirements of valve steels are frequently incompatible. The problems involved have given rise during the past few years to intensive study, both in Europe and America, of heat-resisting steels and particularly of the special austenitic steels which have been developed from the original stainless steel containing 13 per cent of chromium. These researches, together with the practical experience of valve steels of many different compositions, have made it possible to obtain a general knowledge of the effects of the various elements in complicated alloys. The results of extensive research and experience are reported in the paper.

Inhibitors in Cracked Gasoline—I. Relation of Structure to Inhibiting Effectiveness

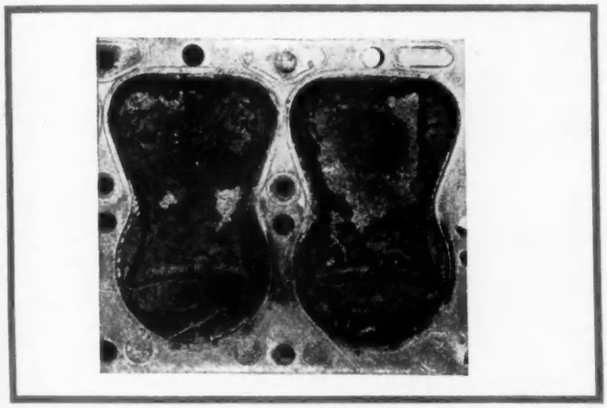
By Gustav Egloff, J. C. Morrell, C. D. Lowry, Jr., and C. G. Dryer. Published in *Industrial and Engineering Chemistry*, December, 1932, p. 1375. [G-1]

The authors stress that the increased demand in recent years for antiknock motor fuel has made the problem of gasoline stability, as to color, gum, and knock rating, of great importance. Some cracked gasolines of high quality, which are satisfactory for use when produced, deteriorate in storage, so that they become dark in color, high in gum, and of lessened knock rating. The studies reported in this paper were directed toward finding substances which will prevent depreciation of gasoline quality.

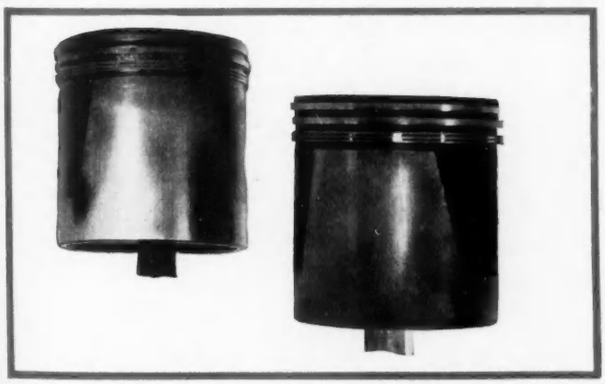
The testing of a large number of substances by an accelerated oxidation test demonstrated that many will increase the induction period of gasoline. Storage tests indicated that substances doing this will also check gasoline deterioration for a considerable period. Definite relationship was demonstrated between structure and inhibiting effectiveness. The substances found to have pronounced inhibiting properties are discussed in detail.

(Concluded on page 42)

Note how carbon is packed and hardened on piston head. Carbon like this causes overheating and loss of power. It is easily removed with Remo.



This carbon has been treated with Remo. It is now soft, dry and "flaky"—ready to be blown out through the exhaust.



Left: normal carbon deposits on piston rings and in ring grooves. Right: thoroughly clean, after Remo treatments.

This is how gums may impair the efficiency of intake valves. Remo will prevent such deposits.

Your test cars may not need

REMO

but—

how about the cars that make your reputation?

A test car, well cared for, running steadily from morning till night, seldom collects much carbon. But in the average car on the road, repeatedly starting and stopping, idling at traffic lights, and rolling down hills against engine compression, enough carbon forms in a thousand miles to interfere with proper cooling. Then, volumetric efficiency and power go down, and overheating and pre-ignition often result.

Because engineers know all this, compression ratios are set lower than can be satisfactorily used in test cars. Equip your production cars with REMO and permit owners also to enjoy high compression and preserve new car performance.

REMO removes gums and carbon every 1,000 miles, at the touch of a button. It is much more economical and much less trouble than having carbon scraped or burned out. And it accomplishes much more. This scientific gum solvent removes the gums that cause sticking of inlet valves. It cleans out the sticky accumulations that cause binding and clogging of piston rings. And it thoroughly dissolves the binder of combustion chamber deposits so that they loosen and blow away with the exhaust gases.

REMO repays its cost to you many times over, in greater car-owner satisfaction. An AC engineer will be glad to bring you full information.

AC SPARK PLUG COMPANY

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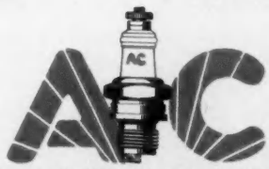

FOR BETTER ENGINE PERFORMANCE

NOTES AND REVIEWS

Concluded

Measurement of Metal Temperatures on Heat-Receiving Side of Heat-Exchanging Apparatus

By Arthur Williams. Paper presented at the Annual Meeting, The American Society of Mechanical Engineers, Dec. 5 to 9, 1932, New York City. [G-1]

Modern design of heat-transfer apparatus frequently involves use of very high metal temperatures. In measuring the temperature of metal walls under operating conditions, thermocouple wires are attached to the outside wall. The wires pass through a high-temperature zone, as in the case of hot flue gases, and are heated above the temperature of the wall, this heat flowing through the wires to the junction. To determine the magnitude of this error, tests were made under severe operating conditions.

Tentative Method of Test for Knock Characteristics of Motor Fuels

Tentative Standard D357—33T published by the American Society for Testing Materials, Philadelphia, 1933. [G-1]

The Cooperative Fuel Research Motor Method for determining the knock characteristics, in terms of octane numbers, of gasolines and equivalent fuels for use in spark-ignition engines, other than engines for aircraft, has been approved by the A.S.T.M. as a Tentative Standard and is available as A.S.T.M. Designation:D357—33T.

"Indice d'Iso-octane" pour les Carburants et "Indice de Cétène" pour les Huiles Combustibles

By A. Grebel. Reprint from *Mémoires de la Société des Ingénieurs Civils de France*, January-February, 1933. 31 pp.; 9 illustrations. [G-1]

A critical study is made of the iso-octane and cetene indices for the appraisal of the combustion characteristics of gasolines and fuel oils respectively. The author presents his reasons for believing that these are not methods of permanent scientific value. However, he recommends that they be adopted provisionally for practical purposes for the rough classification of fuels, according to their combustion characteristics. He urges that scientific analytical study of the behavior of fuels in current engines be continued, and as an aid to this study explains his "realistic" combustion diagram proposed as a substitute for the conventional type.

Recent Progress Rapid in Design of Automatic Transmissions

By Walter C. Keys

Consulting Engineer, Detroit

THE TERM "automatic transmission" is defined as meaning an automatically shifting sliding-gear or sliding-dog-clutch transmission with certain fixed gear-trains, or any type of mechanism which will produce automatically an infinite number of ratios between engine speeds and driving-wheel speeds.

Various types of drive are considered, as well as typical automatic gearshifts, emphasis being given to the operation of the Tyler transmission clutch and to the Mono-Drive transmission. Other subjects are the reactions of operators to automatic gearshifting and the future of automatic transmission.

The desirable features of an automatic transmission are stated as being reliability; quiet operation; reasonable cost, weight, simplicity and efficiency; and correct functioning, which means that it must do the right thing at the right time. The author believes that automatic transmissions will come into use before streamlining, and that they will constitute the next important sales feature on automobiles.

THE genus automobile evolved from many industries, one of which furnished the uni-direction gasoline engine operating on the Otto cycle. While this engine has been developed to the point where it now operates in the hands of a non-mechanical public with almost unbelievable reliability, it still retains the inherent objection of developing no torque at no speed and very low torque at low speed. To utilize its power for starting and accelerating, a road vehicle has always required a mechanism interposed between the engine and the driving wheels to permit comparatively high engine-speeds at all speeds of the vehicle. This mechanism has taken numerous forms in each of the following types (*a*) the sliding-gear transmission; (*b*) friction drive; (*c*) electric drive; (*d*) hydraulic drive; and (*e*) torque converters.

The term "automatic transmission" may be assumed to mean an automatically shifting sliding-gear or sliding-dog-clutch transmission with certain fixed gear-trains, or any type of mechanism which will produce automatically an infinite number of ratios between engine speeds and driving-wheel speeds.

An early and familiar friction drive was that of the Cartercar, shown in Fig. 1. A driving friction disc is secured to the crankshaft and a driven friction disc is keyed to and slidably mounted on a transverse shaft which, in turn, drives the rear axle through a chain enclosed in a housing. A control lever at the right can be moved by the operator, causing the driven disc to move laterally, thus changing the ratio between speeds of the driving and driven discs, or effecting reverse. The advantages included simplicity, an infinite number of ratios and a reduced number of parts. Among the disadvantages were excessive vertical height and the possibility of excessive slipping of the driving member on the driven friction member, causing damage and failure which usually occurred at places where the "going" was bad and reliability most necessary. The possibilities of friction drive have not been exhausted, and its adaptation to automatic transmissions for present-day automobiles should be intriguing to engineers.

Another form of infinitely variable ratio drive was typified in the Owen Magnetic car. The electric transmission is shown in Fig. 2 and the various controls in Fig. 3. Anyone who drove one of these cars 16 years ago carries with him the

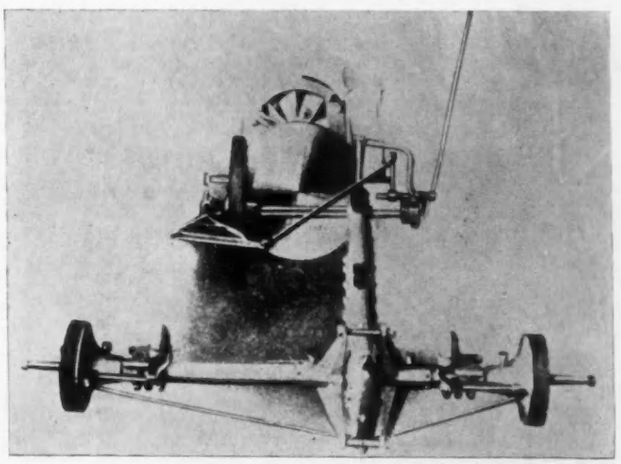

Fig. 1—Friction Transmission of the Cartercar

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